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REPORT OF SURVEY, NORTH PLATTE RIVER, TORRINGTON, WYOMING, BRIDGEPORT, NEBRASKA, NOVEMBER 30-DECEMBER 6, 1962

Public Health Service
Kansas City, Missouri

1962

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REPORT OF SURVEY

NORTH PLATTE RIVER

TORRINGTON, WYOMING - BRIDGEPORT, NEBRASKA

NOVEMBER 30 - DECEMBER 6, 1962

By

Public Health Service Regions VI & VIII

Wyoming Department of Public Health

Nebraska Department of Health

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N81p/3 Report of survey, North Platte River, Torrington, Wyoming-Bridgeport, Nebraska, November 30-December 6, 1962. [1963] (Regions 6 & 8) [prepared in cooperation with Wyoming Department of Public Health and Nebraska Department of Health] No copy 8/71

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SECTION I

Chemical & Bacteriological

ACKNOWLEDGEMENTS

The assistance of several agencies, industries, and individuals in planning this survey was invaluable (see page 4).

Laboratory facilities, with staff, were provided by the Public Health Service Sanitary Engineering Center, with assistance being rendered by the Western Branch of the Nebraska State Health Department Laboratories.

Samples were collected by personnel from the Nebraska Department of Health, Section of Environmental Health, and from Regions VI and VIII of the Public Health Service.

The Wyoming State Hydrographer provided flow data for the Wyoming stations; and the Nebraska Department of Water Resources provided flow data for the Nebraska river stations. Flow data for the Nebraska industrial sampling points were computed by the Nebraska Department of Health.

The State Sanitary Engineers of Wyoming and Nebraska reviewed the report prior to distribution, as did representatives of the Sanitary Engineering Center and Region VIII of the Public Health Service.

REPORT ON
NORTH PLATTE RIVER SURVEY
WYOMING-NEBRASKA
NOVEMBER AND DECEMBER, 1962

BACKGROUND

There is a long history of water quality surveys for the reach of the North Platte River extending from Torrington, Wyoming downstream to Broadwater, Nebraska. Recent surveys were made in 1960, 1961, and 1962.

In December of 1960, studies were made to determine the effects of wastes on bacteriological, chemical and physical qualities of the North Platte River. In November of 1960, a biological survey of the River was made for the reach between Torrington, Wyoming and Mitchell, Nebraska. An additional biological study was made during August of 1961, involving the reach of the River from Torrington, Wyoming to Bridgeport, Nebraska. The purpose of these studies was to determine whether or not the stream was polluted in Nebraska, and to locate the sources of pollution, as well as to determine the effects on downstream water uses.

As a result of these studies and at the request of the Nebraska State Health Department, a Conference was called by the Secretary of the Department of Health, Education, and Welfare on September 12, 1961 at Scottsbluff, Nebraska. This Conference was held in accordance with the provisions of the Federal Water Pollution Control Act. The conferees recommended in part that "the Public Health Service, in cooperation with State agencies, municipalities and industries

involved, will conduct an investigation and study of the River during the current 1961-1962 beet sugar campaign to obtain bacteriological, biological, chemical, streamflow, and other pertinent data to properly assess the sources of industrial and municipal wastes, the kinds of coliform bacteria present in the River, and the effects on water quality."

To comply with this recommendation it was necessary to study the reach of the river involved prior to and during the 1961-1962 beet sugar campaign. Accordingly, in September and again in November 1961, the Public Health Service in cooperation with the States of Wyoming and Nebraska conducted stream studies to obtain the necessary data for properly evaluating the effects of industrial and municipal wastes on the North Platte River. Information obtained in these surveys was published in a report dated February 1962.

The second session of the Conference in the matter of pollution of the interstate waters of the North Platte River, Wyoming-Nebraska, was convened on March 21, 1962, at Cheyenne, Wyoming, to consider the data obtained from the River studies completed in September and November 1961. The conferees of this second session heard statements pertaining to the reach of the River under consideration. These statements were presented by the States involved, various industries and municipalities. In addition, the September-November 1961 report was presented by the Public Health Service. On the basis of the information presented, the conferees recommended, among other things, that: "A program for sampling, analyzing and monitoring the effects of discharges from the industrial sources on the River from Torrington,

Wyoming to Broadwater, Nebraska, will be established and in operation by the beginning of the 1962-1963 beet sugar campaign. The program will include but not be limited to analysis of dissolved oxygen, BOD, suspended solids and the nature of bacteria present.

"The Federal government has an obligation in connection with that program, but industry should be given an opportunity to inaugurate and conduct this activity in cooperation with the State water pollution control agencies. Accordingly, the Wyoming Department of Public Health and the Nebraska Department of Health will furnish the Department of Health, Education, and Welfare details of the program by August 1, 1962, so that the Department of Health, Education, and Welfare can evaluate the situation.

"It is understood that the Department of Health, Education, and Welfare will be called upon in the event the monitoring program indicates the presence of fecal streptococci or fecal coliforms."

To facilitate the implementation of this monitoring program, a meeting of representatives of concerned agencies and industries was arranged by the Nebraska State Sanitary Engineer, for the purpose of discussing and formulating a cooperative plan to monitor the North Platte River between Torrington, Wyoming and Broadwater, Nebraska. This meeting was held at the City Hall, Scottsbluff, Nebraska on September 12, 1962 with the following in attendance:

Lee Hall	Radio Station KOLT	Scottsbluff
H. D. Burk	Great Western Sugar Company	Scottsbluff
J. E. Browning	Holly Sugar Corporation	Colorado Springs
Oscar Wieberg	Scotts Bluff County Health Dept.	Gering

Don Christensen	Scottsbluff Star-Herald	Scottsbluff
T. H. Vanderhoof	West Nebraska Branch Laboratory	Scottsbluff
J. W. Fitzpatrick	U. S. Public Health Service	Denver
A. E. Williamson	Wyoming Dept. of Public Health	Cheyenne
T. A. Filipi	Nebraska Dept. of Health	Lincoln
D. A. Crawley	U. S. Public Health Service	Kansas City
R. G. Hunsinger	U. S. Public Health Service	Kansas City
F. W. Kittrell	U. S. Public Health Service	Cincinnati

A general plan regarding the sampling stations, analyses to be performed, assignment of responsibilities and other general functions was agreed upon by participants at the meeting.

SCOPE OF SURVEY

A monitoring survey for the reach of the North Platte River between Torrington, Wyoming and Bridgeport, Nebraska was planned and conducted by the Public Health Service and the States of Wyoming and Nebraska in late 1962. The survey was designed to obtain data for evaluating improvement in River water quality following the construction of pollution abatement facilities by municipalities and industries subsequent to the 1961 survey. This survey was conducted as nearly as possible in conformance with procedures followed in preceding surveys.

The sampling stations selected were at the same locations with the same numerical designations as those of the 1961 survey. Since this was a monitoring survey, it was decided that not all previous stations needed to be sampled; accordingly, only those deemed necessary to reflect the general condition of the River were utilized (See Table I). Figure 1 shows the comparative locations of the sampling points and sources of wastes.

While the number and type of analyses to be performed were somewhat limited by the laboratory facilities available, it was determined that the following analyses would be adequate to provide a basis for judging material changes in the North Platte River water quality:

Dissolved Oxygen
Biochemical Oxygen Demand
Suspended Solids
Suspended Volatile Solids
MPN
Fecal Coliform
Fecal Streptococci

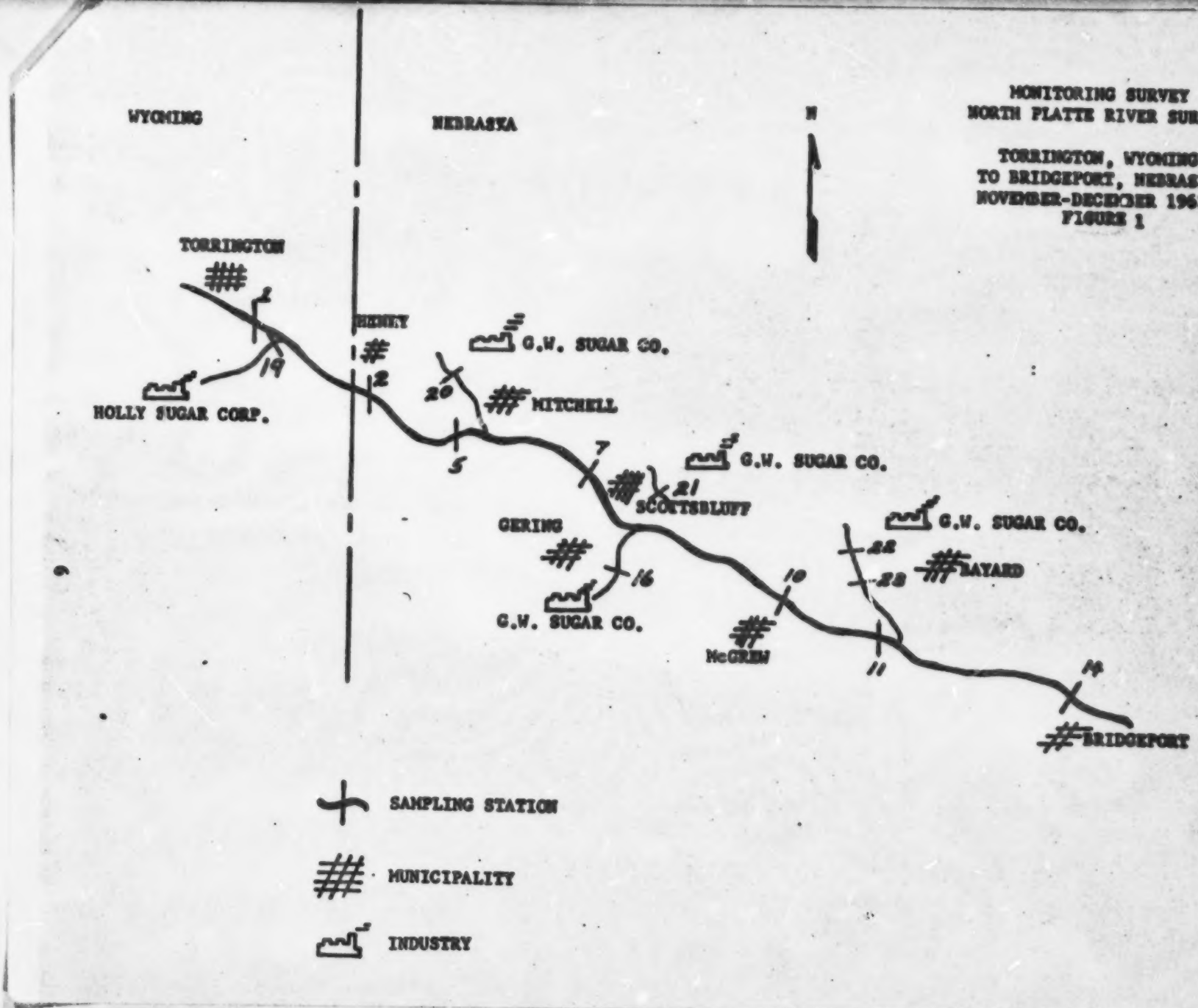
WYOMING
NEBRASKA
N
MONITORING SURVEY
NORTH PLATTE RIVER SURVEY
TORRINGTON, WYOMING
TO BRIDGEPORT, NEBRASKA
NOVEMBER-DECEMBER 1962
FIGURE 1
TORRINGTON
HENNEY
G.W. SUGAR CO.
HOLLY SUGAR CORP.
MITCHELL
G.W. SUGAR CO.
SCOTTSBLUFF
GERING
G.W. SUGAR CO.
G.W. SUGAR CO.
BAYARD
McGREW
BRIDGEPORT
1
19
2
20
5
7
21
16
10
22
23
11
14
SAMPLING STATION
MUNICIPALITY
INDUSTRY

TABLE NO. I

List of Sampling Stations

Station 1	North Platte River at Torrington Bridge
Station 19	Holly Sugar Corporation outfall
Station 2	North Platte River at Henry Bridge
Station 5	Mitchell Bridge
Station 20	Mitchell Great Western Plant outfall
Station 7	North Platte River at Scottsbluff 20th Street Bridge
Station 16	Gering Great Western Plant outfall
Station 21	Scottsbluff Great Western Plant influent to lagoon
Station 21W	Scottsbluff Great Western Plant outfall West
Station 21E	Scottsbluff Great Western Plant outfall East
Station 10	North Platte River at McGrew Bridge
Station 11	North Platte River at Bayard Bridge
Station 22	Bayard Great Western Plant influent
Station 23	Bayard Great Western Plant outfall
Station 14	North Platte River at Bridgeport Bridge

All but two of the analyses were performed in accordance with "Standard Methods for the Examination of Water and Waste Water," eleventh edition, 1960. The two exceptions were examinations for fecal coliform and fecal streptococci as adapted for water pollution studies. In addition to these determinations, a biological evaluation of aquatic life in the stream was scheduled. (See Section II).

The upper and lower extremities of the stream to be considered were Torrington, Wyoming and Bridgeport, Nebraska, respectively.

THE SURVEY

The chemical and bacteriological portion of the survey was conducted during the seven-day period from November 30 through December 6, 1962. The samples were collected by Regions VI and VIII of the Public Health Service and the Nebraska Department of Health. Two of the four people assisting in sample collection also collected samples during the September-November 1961 survey.

Laboratory facilities were provided by the Public Health Service, Sanitary Engineering Center by stationing a mobile laboratory at the City Hall, Scottsbluff, Nebraska. This laboratory was staffed by a chemist and a bacteriologist from the Public Health Service (the bacteriologist also performed similar analyses during the September-November 1961 survey). Assistance in laboratory determinations was provided, as needed, by the Nebraska West Branch Laboratory.

River samples were "grab samples" collected daily at each river station. Composite samples were collected daily at each beet sugar plant waste line and at the effluent from the Bayard Great Western treatment device. The composite was made up of three portions

collected at approximately two-hour intervals, beginning about 8:00 a.m.

HYDROLOGIC DATA

North Platte River streamflows (Table II) were determined by the State Hydrologist, Torrington, Wyoming; the Nebraska Department of Water Resources, Bridgeport, Nebraska; and the U. S. Geological Survey, Casper, Wyoming.

The Wyoming State Hydrologist made flow determinations on the Holly Sugar Corporation plant outfall (Table III). These determinations were reported as average daily figures compiled from several daily determinations.

The Great Western Sugar Company fabricated and installed a Parshall flume on each waste effluent line. In addition, at each of the two plants (Scottsbluff and Bayard) where waste treatment facilities were in operation, a Parshall flume was installed on the treatment device influent line. Recording instruments were installed at appropriate Parshall flumes and serviced during the entire survey by the Nebraska Department of Health. Waste water flows for the Nebraska plants were computed by the Nebraska Department of Health (Table III).

At the Bayard Great Western plant waste is pumped from the plant waste effluent ditch to the treatment facility. The by-pass line at the pump station noted in the November 1961 survey has not been removed, and at practically every observation was discharging an estimated five to 10 percent of the plant waste, with the average approaching the higher figure. The raw waste by-passing the treatment facility was

TABLE NO. II - STREAM FLOW DATA IN CFS

Date	Sampling Station Number, Location and River Mile						
	1	2	5	7	10	11	14
	Torrington	Henry	Mitchell	Scottsbluff	McGrew	Bayard	Bridgeport
	208.8	199.0	184.0	177.3	160.2	154.6	141.8
11-30-62	277	320	552	598	893	930	1,100
12-1-62	277	320	552	598	893	930	1,120
12-2-62	277	308	557	603	890	927	1,080
12-3-62	277	320	557	603	891	928	1,110
12-4-62	277	326	543	589	880	917	1,100
12-5-62	277	314	534	580	864	901	1,070
12-6-62	277	320	543	589	875	912	1,080
AVERAGE	277	318	548	594	884	921	1,094

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TABLE NO. III - INDUSTRIAL FLOWS IN CFS

Date	Sampling Station Number, Location and River Mile						
	19	20	21 1/	16	22		23
	Holly Outfall	Mitchell GW	Scottsbluff GW	Gering GW	Bayard GW	Bayard GW	Bayard GW
	200.8	184-1.5	173.0-3.0	173-1.5	154.5-3.5	154.5-2.5	154.5-2.0
11-30-62	7.48	16.12	Unknown	12.26	8.0E	0.6E	0.84
12-1-62	7.22	15.97		12.21	8.0E	0.6E	1.22
12-2-62	7.23	17.21		12.32	8.0E	0.6E	1.24
12-3-62	6.03	16.74				0.6E	1.24
12-4-62	7.11	17.67		12.31	8.0E	0.6E	1.24
12-5-62	6.18	18.14		12.31	8.0E	0.6E	1.24
12-6-62	----	-----		----	8.0E	0.6E	----
AVERAGE	7.21	16.97	Unknown	12.30	8.0E	0.6E	1.17

1/ This is the influent line; there was no effluent

2/ E - Estimated

discharged to an adjacent irrigation drain and thence to the river.

PHYSICAL OBSERVATIONS

The most significant progress made in cleaning up the North Platte River is the treatment facility operated by the Scottsbluff Great Western beet sugar plant. Wastes from this plant enter two large compartmented holding ponds. The size of these ponds coupled with the high porosity of the soil prevented any controlled discharge from the system during the entire campaign. The levees around the outside of the ponds as well as the partition levees are, however, of a temporary nature and failed on several occasions during the 1962 beet sugar campaign. These failures occurred prior to the survey period.

The Bayard Great Western beet sugar plant treatment facility has been remodeled. The area has been converted to two holding ponds, operating in series, by the construction of a levee around the entire land area, and a partition levee making each pond of approximately the same area. These levees are of a temporary nature and failed on different occasions prior to the 1962 survey. The porosity of the soil in this instance is not nearly as high as that at the Scottsbluff plant. An average of approximately 1.2 cubic feet per second was continuously discharged from this treatment facility. The treatment facility was not as efficient as might be expected. Improper leveling of the bottom of the ponds and failure of the center partition may have resulted in short-circuiting the waste through the system, and certainly minimized the effective capacity of the ponds.

The Holly Sugar Corporation has completed extensive in-plant waste

line modifications, resulting in the removal of all wastes from the River except flume water. Waste lime sludge, Steffens waste, and septic tank effluent are impounded, as are pulp silo under-drain flow and pulp water from the silo separator. These impoundments are large enough to completely contain flows for the entire campaign and have well constructed levees of a permanent nature. Rienks screen dry removal, Link-Belt traveling screen and Link-Belt rotary drum screens (capacity increased 50 percent over 1961) are employed to reduce organic and inorganic particulate matter discharged to the River. The traveling and rotary drum screens are installed in the waste outfall line which contains flume water only, and are of U. S. 40 mesh. Theoretically all particulate matter of 0.0163 inches diameter and larger should be removed from the waste stream. The total volume of liquid waste now being discharged to the River by this plant is approximately 50 percent of the volume discharged in 1961.

It is reported that the Mitchell Great Western and the Gering Great Western beet sugar plants have acquired the necessary land to provide waste treatment facilities.

Present plans are for all other industries along this reach of the North Platte River to discharge their wastes to municipal systems. With few exceptions, the necessary negotiations have been completed (Table IV).

All municipalities on the reach of the North Platte River under consideration, except Bayard, have treatment facilities in various stages of completion (Table IV).

TABLE NO. IV
SCHEDULE FOR CONSTRUCTION
of
POLLUTION ABATEMENT FACILITIES
(North Platte River - Torrington, Wyo. to Bridgeport, Nebr.)
December 6, 1962

Source 1/	Status	Estimated Completion Date	Remarks
Wyoming			
Torrington	Completed 1959		Operating
Holly Sugar Corp.	Completed 1962		Operating
Nebraska			
Henry	Completed 1962		Operating
Lyman	Planning		
Morrill	Planning		Final plans approved
Mitchell	Planning		Final plans approved
G.W. Sugar Co.	Site acquired		No construction
Scottsbluff	Completed 1962		Not operating
G.W. Sugar Co.	Completed 1962		Operating
Terrytown	Planning		
Gering	Planning		
G.W. Sugar Co.	Site acquired		No construction
Minatare	Planning		
Melbeta	Completed		Operating
Bayard			No progress
G.W. Sugar Co.	Remodeled 1962		Operating
Bridgeport	Planning		
Broadwater	Planning		

1/ Industrial waste to municipal system except as noted.

RESULTS OF SURVEY

Since this survey was designed to measure improvement in River water quality following installation of waste treatment facilities, the information is presented as the basis for evaluating progress made in removing pollution from the North Platte River from Torrington, Wyoming to Bridgeport, Nebraska. Numerical values shown on the graphs which follow are averaged results. The individual results obtained are shown in Appendix A.

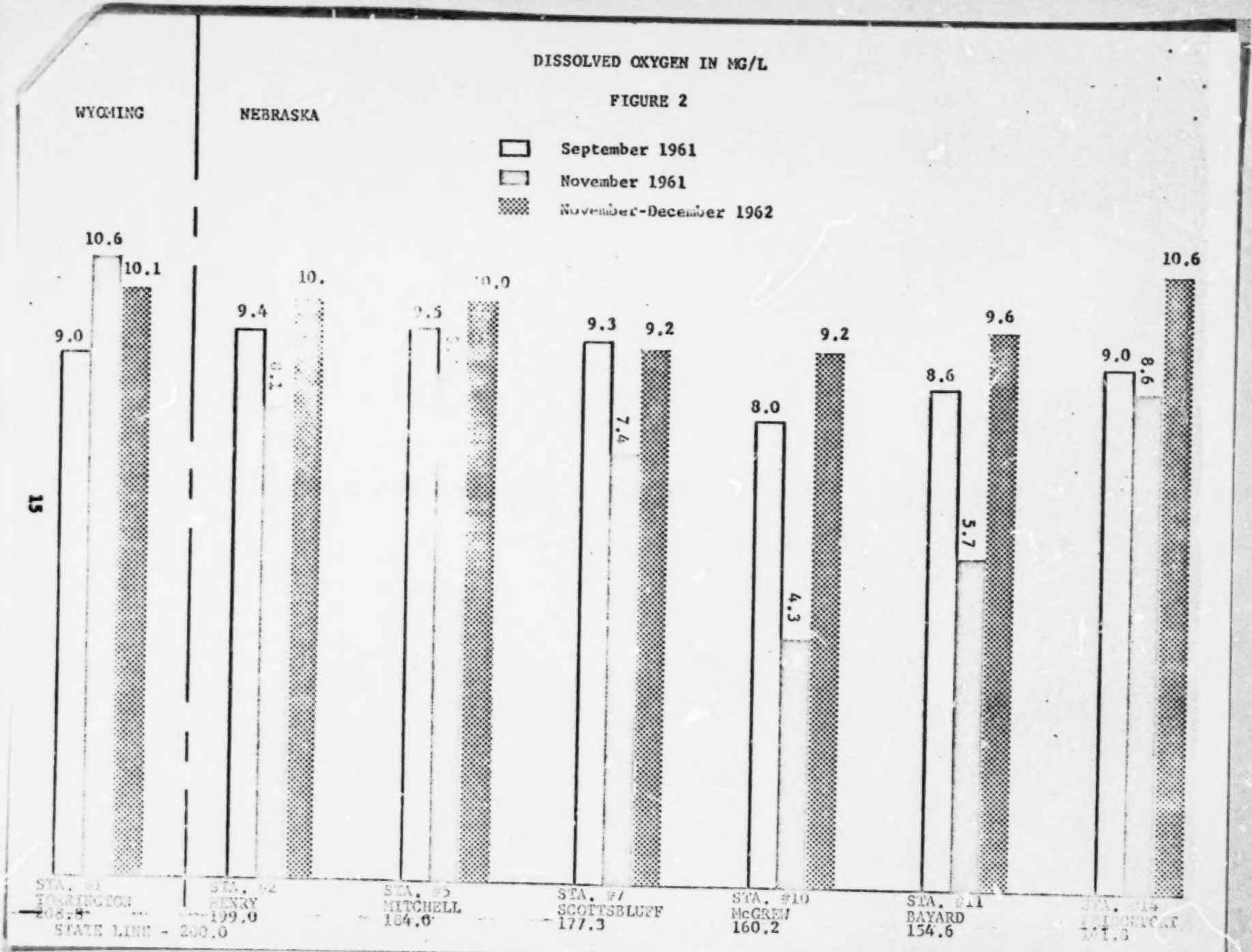
The bar graphs which follow show three values for each river station and two values for each industrial station. The value on the left, center, and right is that obtained during the September 1961, November 1961, and the current survey respectively for the river stations. Only two values are shown for each industrial station.

Figures 2 through 14 show results obtained at the seven river stations, and the information for Figures 15 through 20 was obtained from the beet sugar plants along the reach of the River under study.

Figure 2 indicates the average dissolved oxygen in river samples in milligrams per liter (mg/l) for the three study periods, September 1961, November 1961, and November-December 1962 respectively. The lowest dissolved oxygen concentration for the November 1961 survey was 4.3 mg/l at McGrew, Nebraska. The average figure at McGrew in 1962 was 9.2 mg/l. In examining the graph, it is noted that pollution abatement measures initiated by the Holly Sugar Corporation prior to the 1962 campaign have been effective in decreasing oxygen demand of wastes discharged to the river. The 1961 survey indicated that an average oxygen depletion of 2.5 mg/l occurred from Station 1 to Station 2, whereas the 1962 survey found that the average dissolved oxygen

DISSOLVED OXYGEN IN MG/L

FIGURE 2



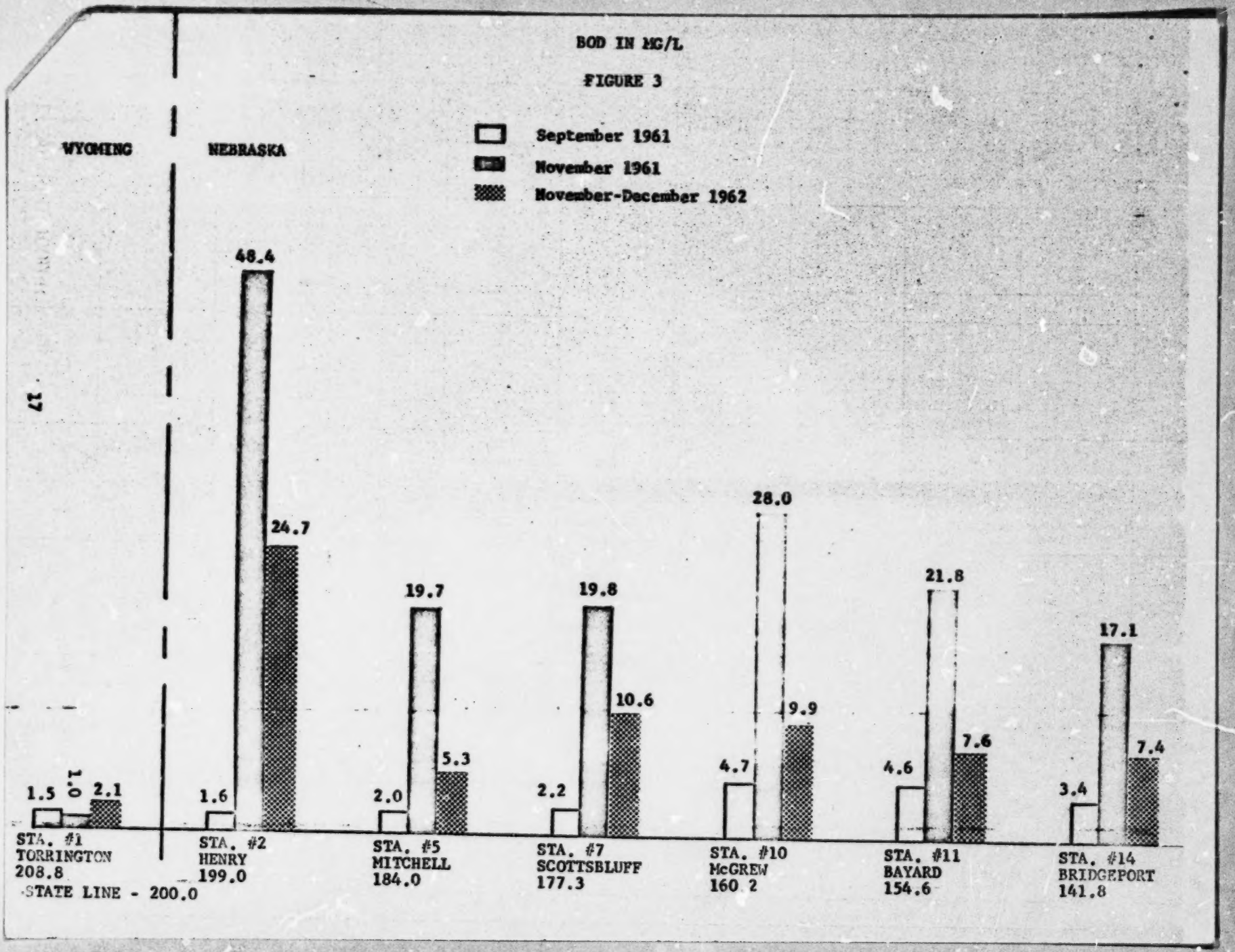
concentration between these two stations remained practically the same.

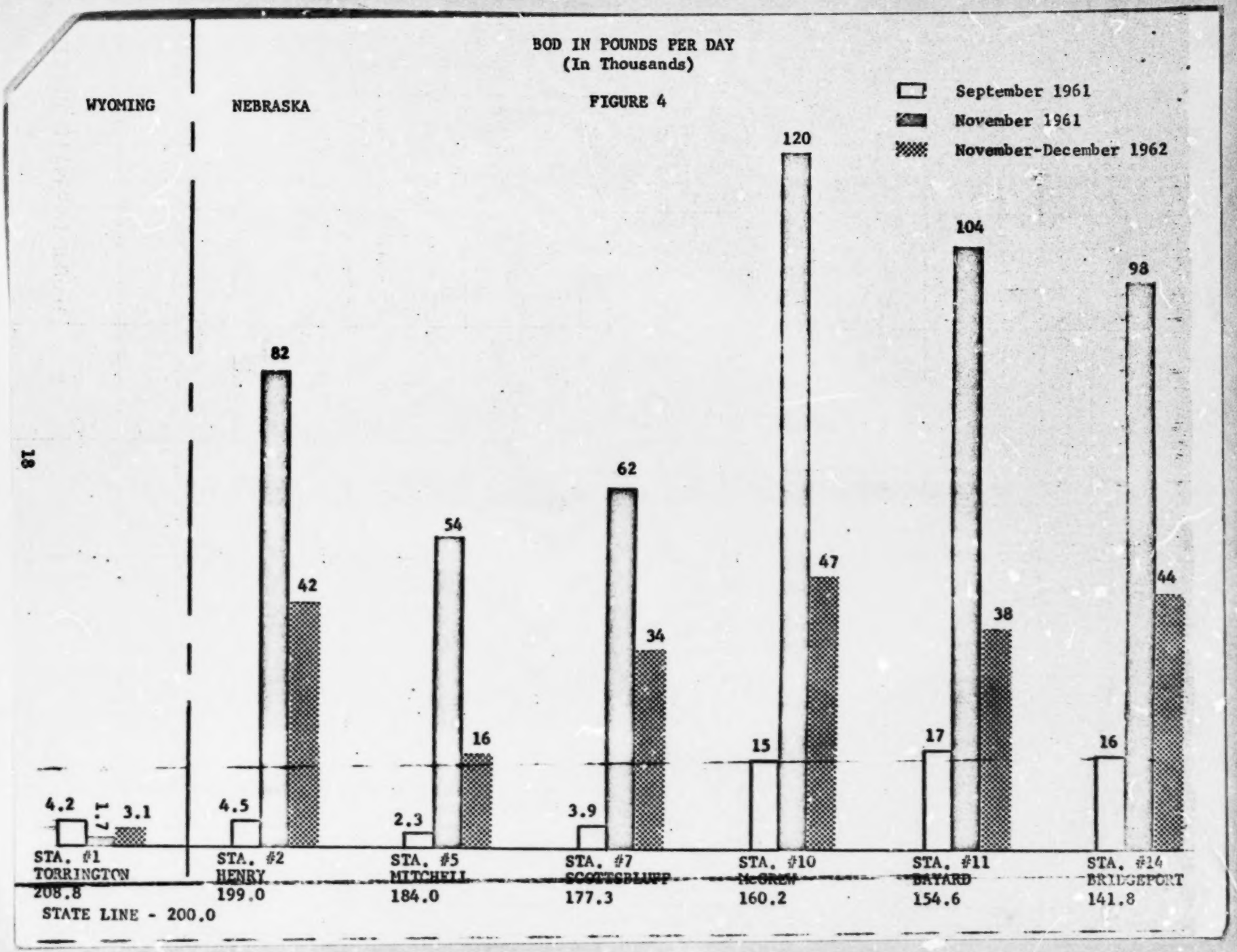
Figure 3 depicts the comparative biochemical oxygen demand in mg/l, and Figure 4 converts the mg/l to pounds per day (in thousands). Station 1 at Torrington, Wyoming, is directly above the Holly Sugar Corporation waste outlet. Station 2 nine miles downstream reflects an appreciable reduction in BOD carried by the stream over that determined by the 1961 survey. This reduction could have been anticipated in view of the fact that the Holly Sugar Corporation has made significant improvements in its waste disposal program. At present, all wastes, except the flume water, have been eliminated from the plant waste stream. All other wastes are pumped to a system of holding ponds large enough to contain the wastes for the entire beet sugar campaign. These ponds have well constructed levees which are designed to effectively serve for a period of years.

Even though the BOD reduction at Station 2 approaches 50 percent, a large BOD still remains in the stream. The average daily BOD load at Station 2 (Figure 4) was computed from laboratory data (See Appendix A) obtained during the 7 day sampling period. The BOD discharge by the Holly Sugar Corporation (Figure 16) as determined by the analysis of daily composite samplings was found to be approximately 19,000 pounds per day. This figure was 103,000 pounds per day in 1961; therefore the pollution abatement activities by the company have effected an approximate 81 percent reduction in pounds of BOD contributed to the stream per day. From Figure 4 it is noted that the BOD at Station 1 averaged 3,100 pounds per day. This figure plus the 19,237 pounds BOD per day discharge by the Holly Sugar Corporation makes a total of 22,337 pounds

BOD IN MG/L

FIGURE 3




BOD IN POUNDS PER DAY
(In Thousands)
FIGURE 4
WYOMING
NEBRASKA
September 1961
November 1961
November-December 1962
18
4.2
1.7
3.1
4.5
82
42
2.3
54
16
3.9
62
34
15
120
47
17
104
38
16
98
44
STA. #1
TORRINGTON
208.8
STATE LINE - 200.0
STA. #2
HENRY
199.0
STA. #5
MITCHELL
184.0
STA. #7
SCOTTSBLUFF
177.3
STA. #10
McGREW
160.2
STA. #11
BAYARD
154.6
STA. #14
BRIDGEPORT
141.8

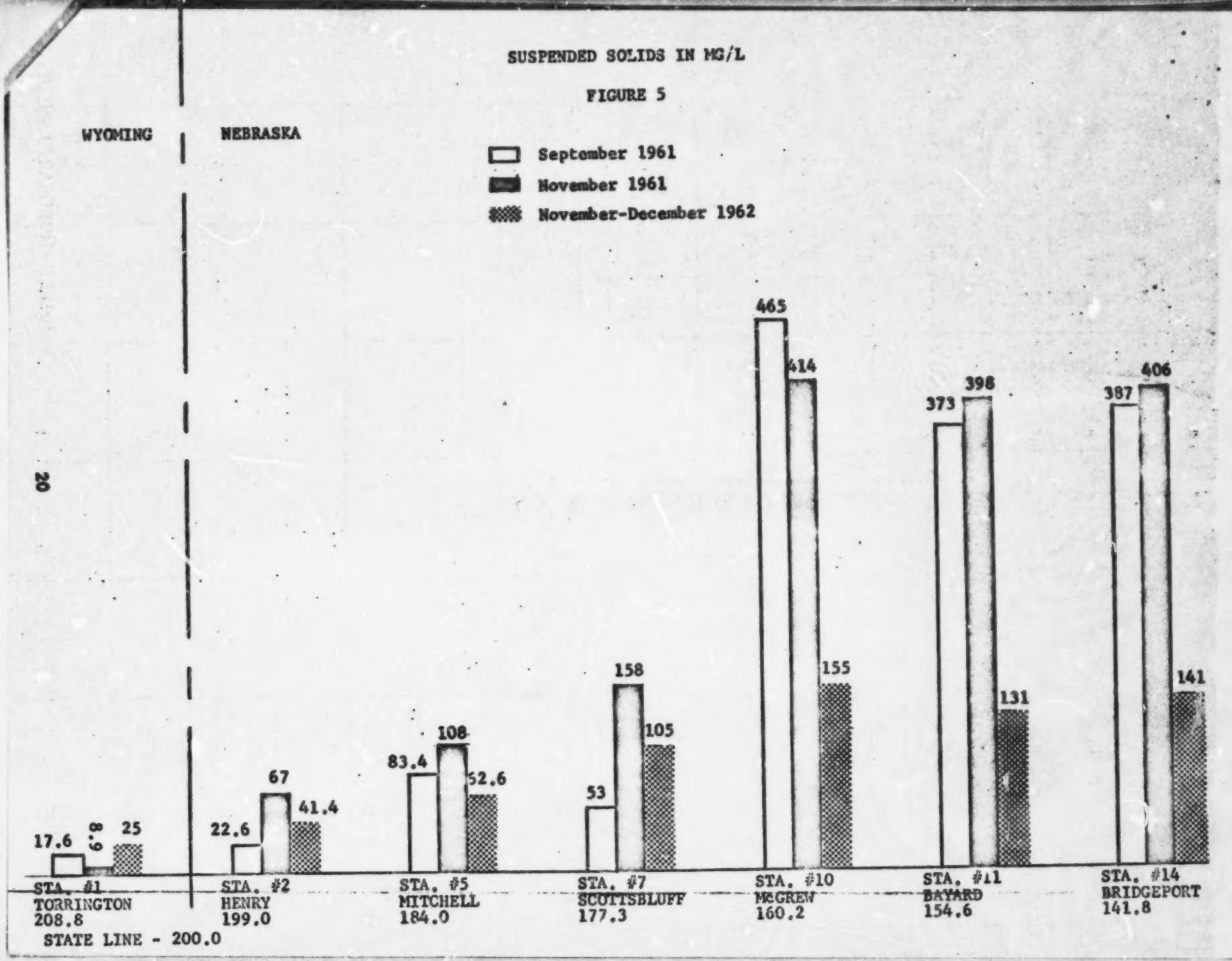
per day which is far short of the 42,000 pounds BOD computed for Station 2. In referring to laboratory data upon which these computations were based it is noted that there was a wide fluctuation in the daily BOD determinations in mg/l at Station 2. The minimum figure for the 7 day sample period being 10 mg/l and the maximum figure 56.4 mg/l. Since the samples collected at Station 2 were grab samples, it is quite likely that a longer sampling period would result in an average BOD concentration more nearly approaching the sum of the average figures computed for Stations 1 and 19. Even though the discrepancy between the pounds per day of BOD discharged by the Holly Sugar Corporation and the pounds per day computed for Station 2 is unusually large, the fact remains that the Holly Sugar Corporation is still discharging to the river large quantities of oxygen consuming materials.

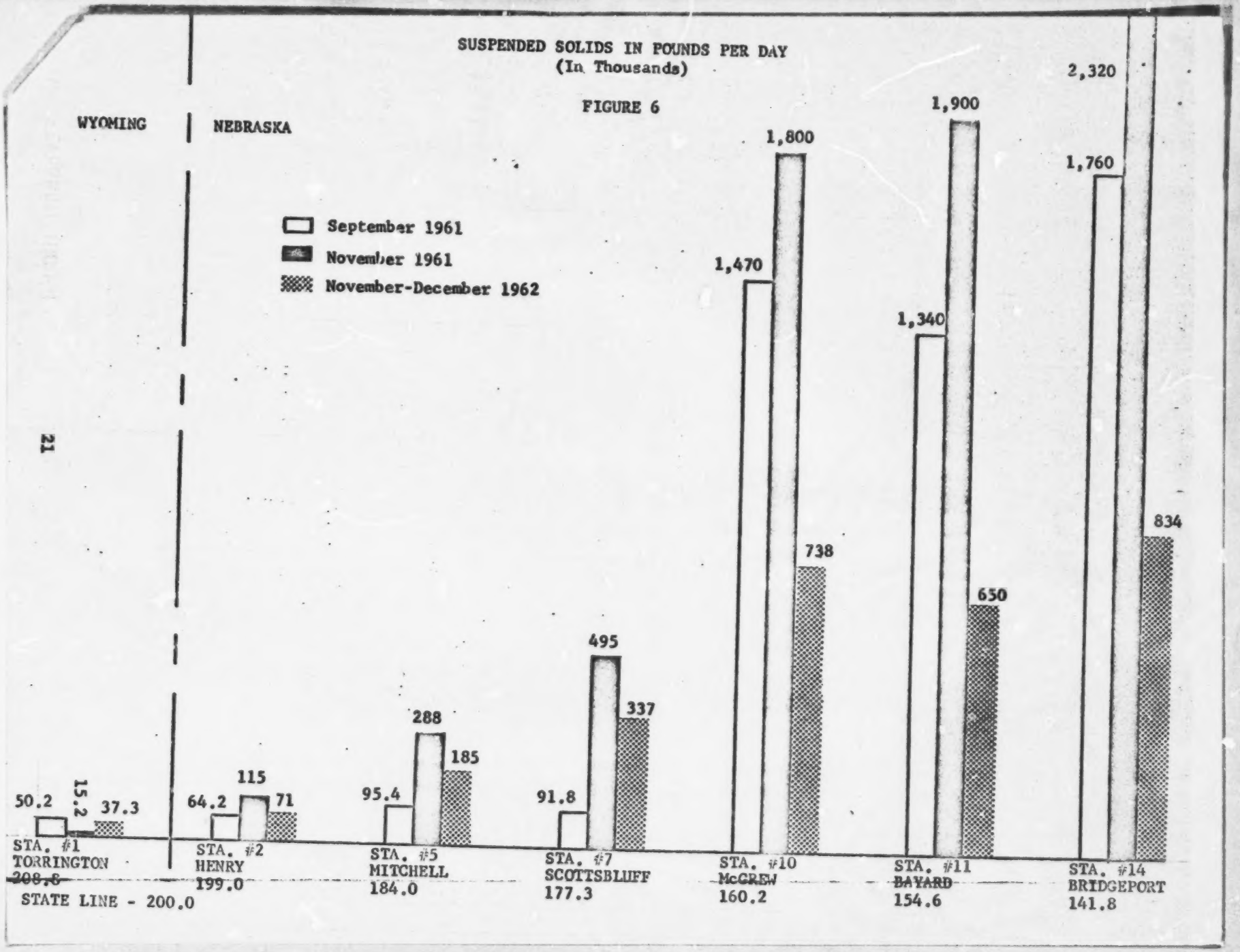
Wastes from the Scottsbluff Great Western Plant were completely impounded by a system of holding ponds during the entire beet sugar campaign, except for some loss reported through levee breaks. The ponds are large and are constructed on porous soil. The rate of percolation in the ponds is high as large areas of the holding ponds were not inundated by the wastes. It is doubtful if there would have been a discharge from the system had the levees not failed. The levees, however, are of a temporary nature, apparently constructed by a bulldozer with no compaction. The soil is loose and susceptible to erosion by wave action. Very little leveling was done in the ponds, and clearing was practiced only where a levee was to be constructed.

Even though construction of the system was of a temporary nature, the effect of complete waste removal by the Scottsbluff Great Western

SUSPENDED SOLIDS IN MG/L

FIGURE 5




SUSPENDED SOLIDS IN POUNDS PER DAY
(In Thousands)
FIGURE 6
WYOMING
NEBRASKA
September 1961
November 1961
November-December 1962
50.2
15.2
37.3
64.2
115
71
95.4
288
185
91.8
495
337
1,470
1,800
738
1,340
1,900
650
1,760
2,320
834
STA. #1
TORRINGTON
208.8
STATE LINE - 200.0
STA. #2
HENRY
199.0
STA. #5
MITCHELL
184.0
STA. #7
SCOTTSBLUFF
177.3
STA. #10
McGREW
160.2
STA. #11
BAYARD
154.6
STA. #14
BRIDGEPORT
141.8

Sugar plant from the North Platte River was very pronounced. This operation alone removed an estimated 98,970 pounds of BOD per day from the stream (Figure 16).

At the time of this survey, the principal sources of wastes entering the stream, in addition to those already mentioned, were the Great Western Sugar plants at Mitchell, Gering and Bayard, Nebraska, and the municipal area at Scottsbluff, Nebraska. As is evidenced by Figure 4, large quantities of BOD are still being discharged to the stream.

Figures 5 and 6 indicate suspended solids in mg/l and thousands of pounds per day, respectively. As can be expected, the results are roughly proportional to those described above relating to biochemical oxygen demand, and the improvement in the stream is apparently the result of waste removal from the stream by the Holly Sugar Corporation and the Scottsbluff Great Western Sugar Company.

Volatile suspended solids in mg/l and thousands of pounds per day are shown in Figures 7 and 8 respectively. The improvement noted in this area is comparable to that described for the suspended solids determinations.

Figures 9 and 10 are based on total coliform determinations in thousands per one hundred milliliters (1,000/100 ml), and in bacterial quantity units respectively. The coliform bacterial count increased from about 60/100 ml at Station 1 to some 112,000/100 ml at Station 2 just below the Wyoming-Nebraska state line. It has been suggested that this large increase in coliform organisms noted in previous surveys, might have been due to a condition promoting incubation of the organisms

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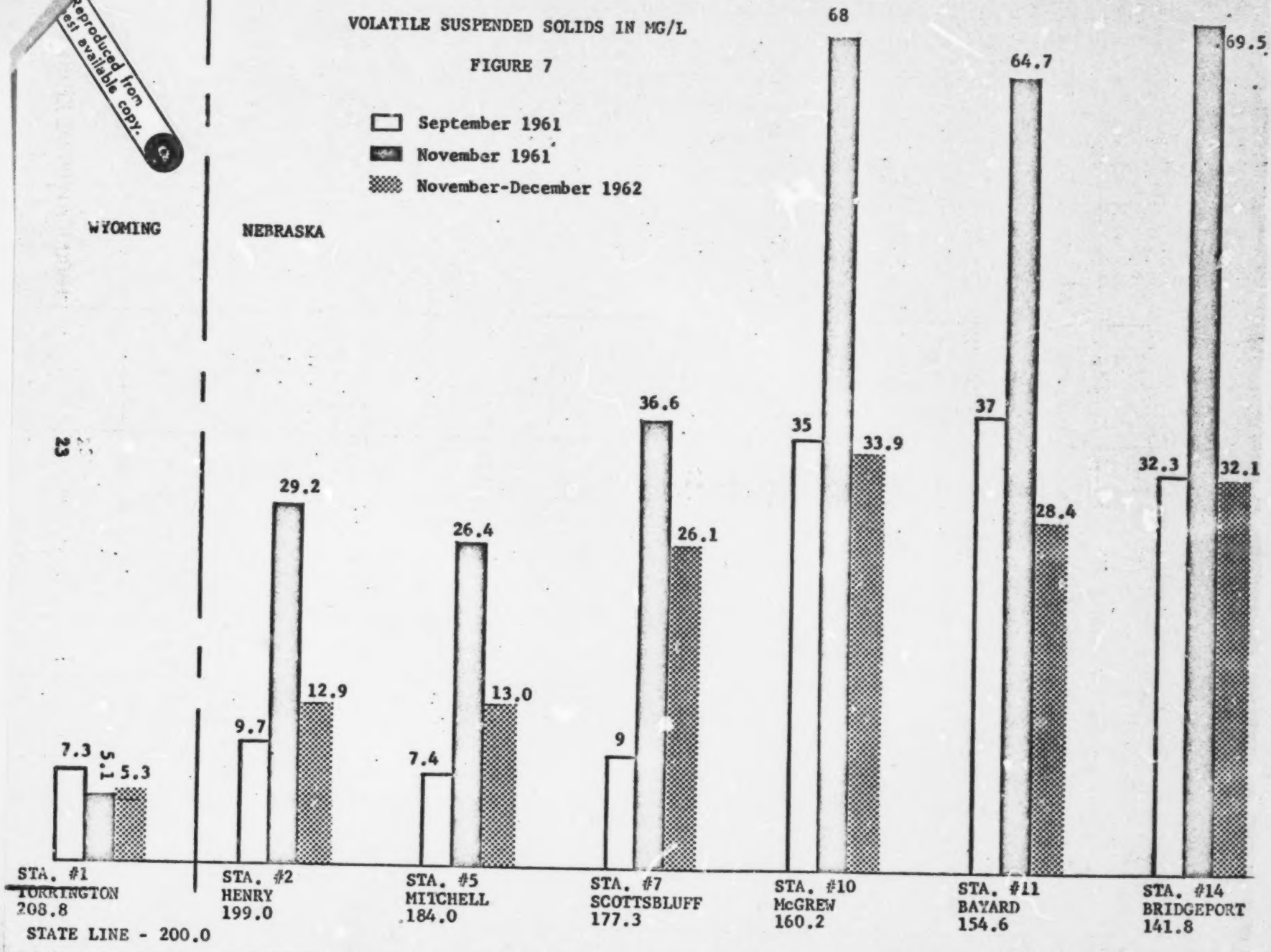
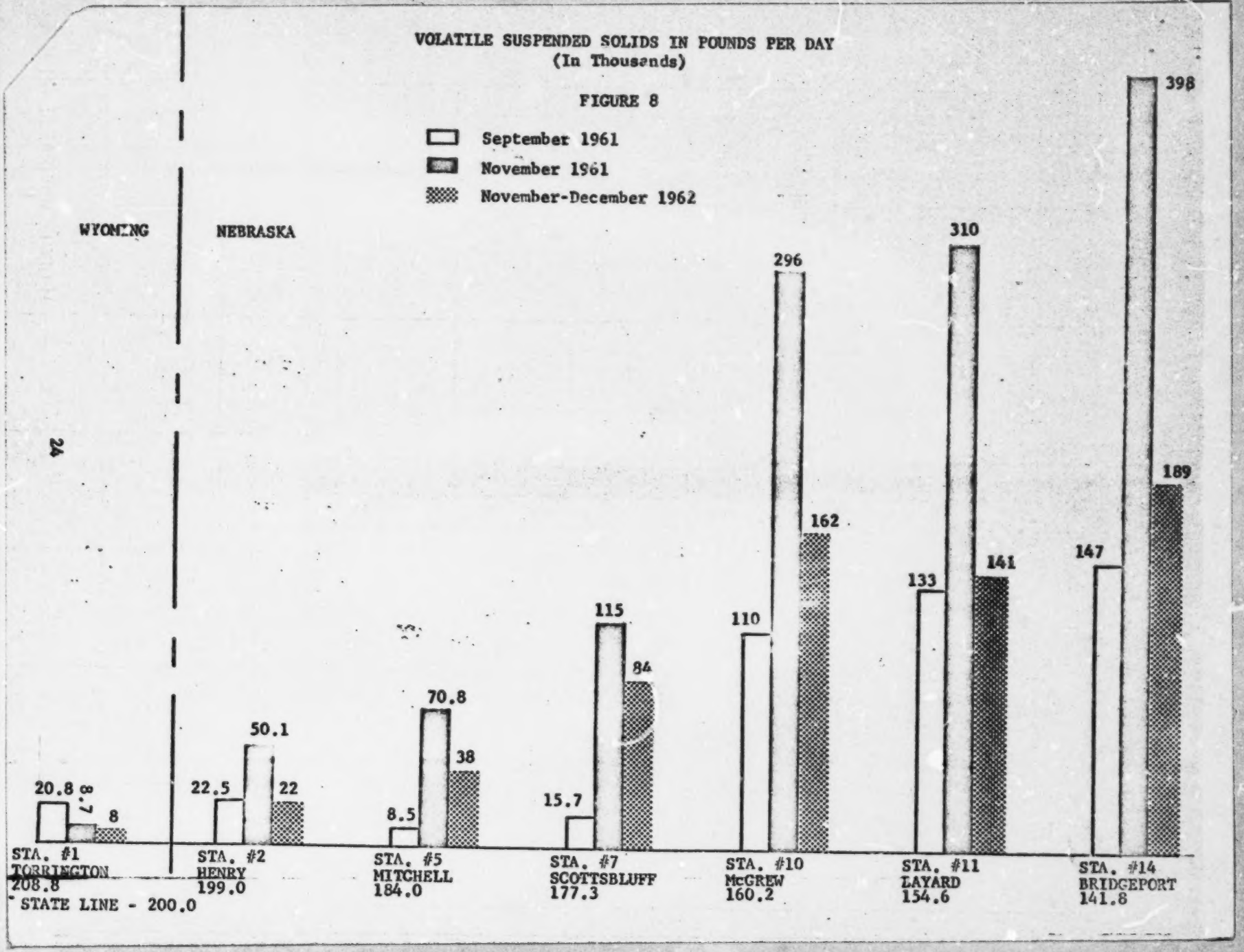
VOLATILE SUSPENDED SOLIDS IN MG/L

FIGURE 7



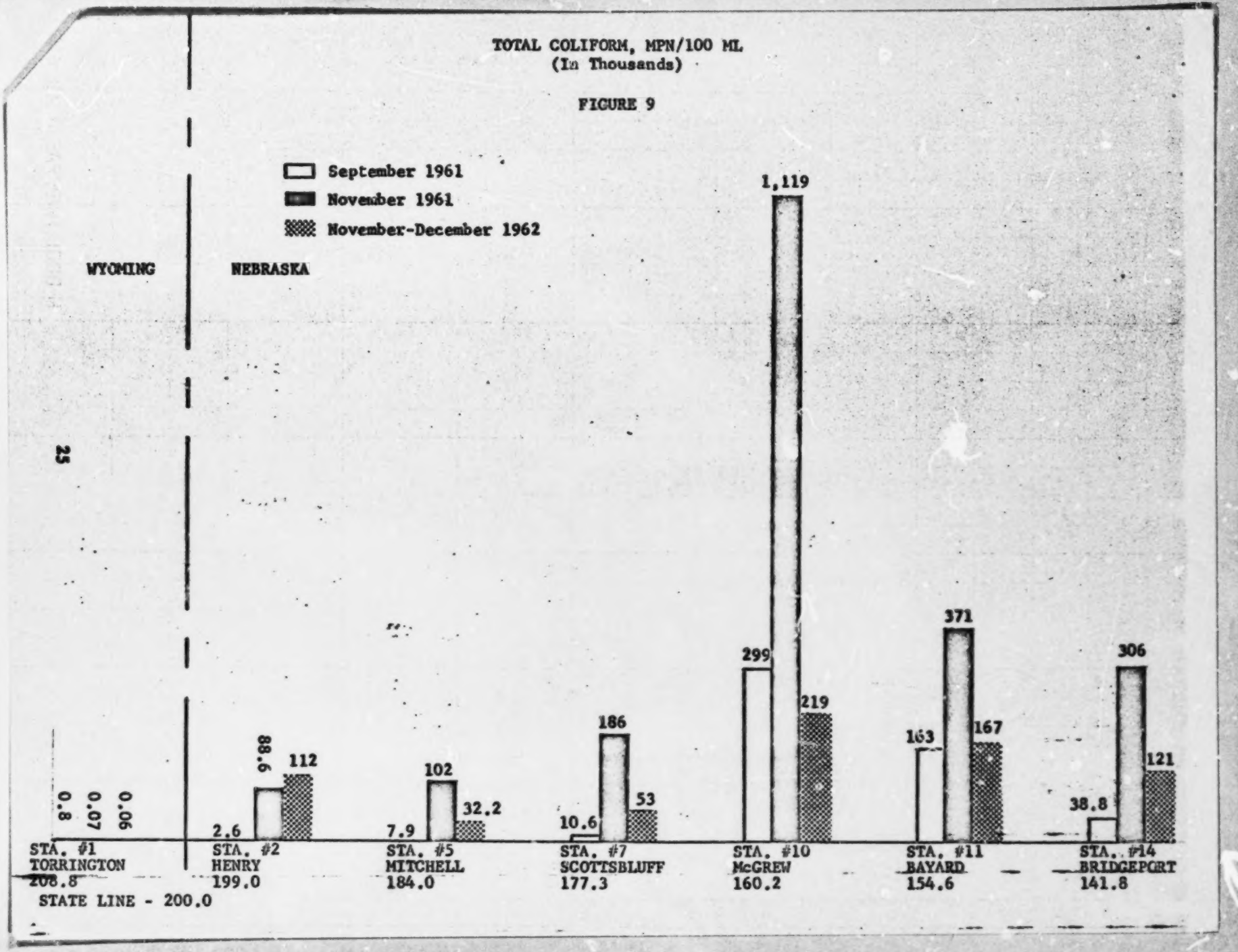
VOLATILE SUSPENDED SOLIDS IN POUNDS PER DAY
(In Thousands)

FIGURE 8



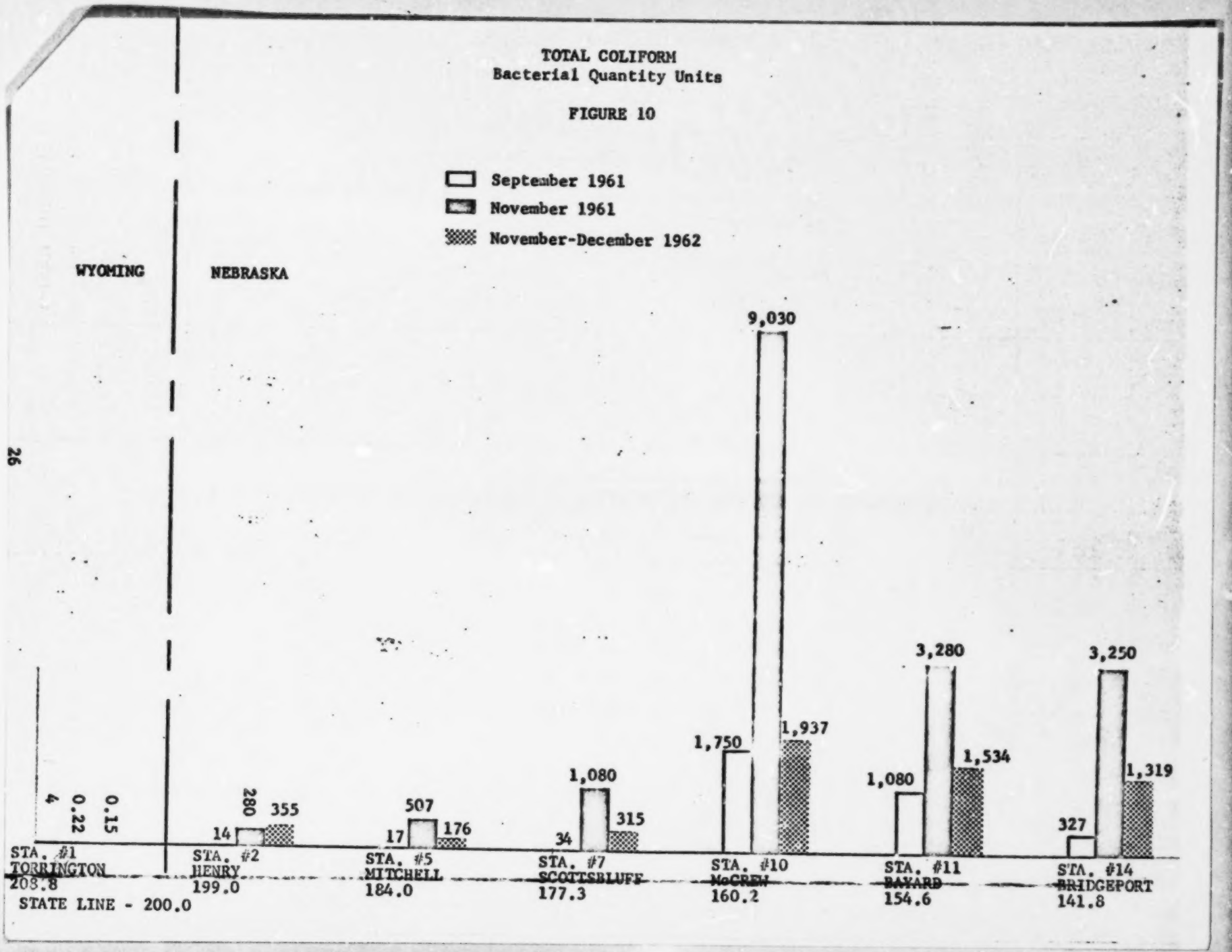
TOTAL COLIFORM, MPN/100 ML
(In Thousands)

FIGURE 9



TOTAL COLIFORM
Bacterial Quantity Units

FIGURE 10



in the Holly Sugar Corporation plant waste system. It was generally conceded that the source of the coliform organisms was the domestic wastes.

Prior to the beginning of the 1962 beet sugar campaign, the Holly Sugar Corporation made the necessary in-plant modifications to preclude the discharge of any domestic wastes to the River. Rather than finding the expected decrease in total coliform, however, it is noted that the total coliform count at Station 2 increased from 88,600/100 ml in 1961 to 112,000/100 ml in 1962 (Figure 9). Since the coliform count at Station 1 is low and increases at Station 2, it must be assumed that the coliform organisms are being discharged by the Holly Sugar Corporation plant.

Samples of sugar beets were collected during this survey and taken to the Sanitary Engineering Center for laboratory examination. Coliform counts were made on the sugar beets and on the soil attached to the beets, and large numbers of coliform organisms were found (Table V). No attempt has been made to date to correlate the coliform numbers found per gram of soil with numbers recovered from the River. It seems logical at this point to assume that the coliform organisms being recovered from the stream are either introduced to the flume water with the soil attached to the beets, or the organisms entering the flume water are being incubated in the flume water. In view of existing knowledge, it seems probable that both are contributory causes.

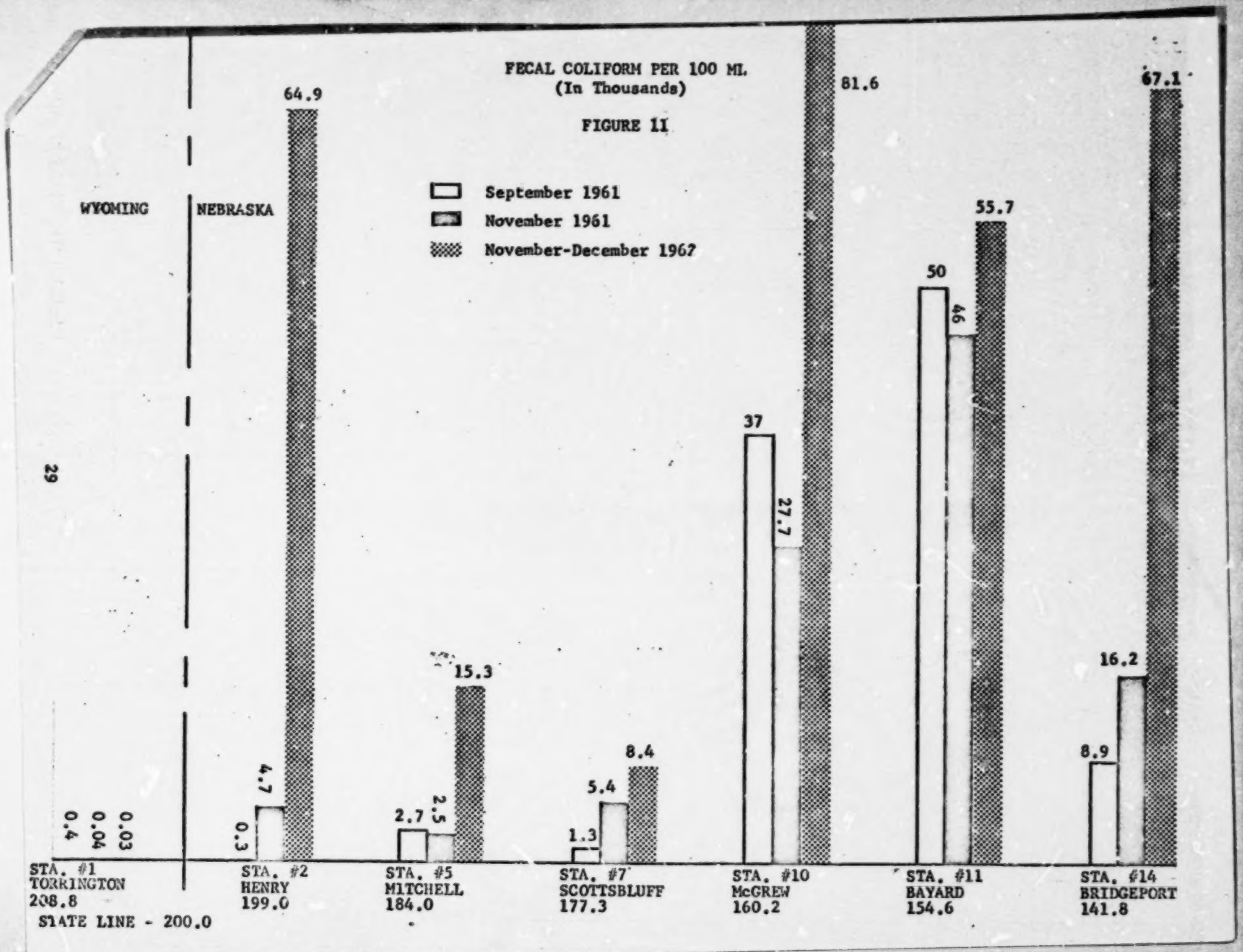
Figures 11 and 12 are based on fecal coliform determinations, indicated in 1,000/100 ml and in bacterial quantity units respectively. The increase in fecal coliform organisms at Station 2 over the survey

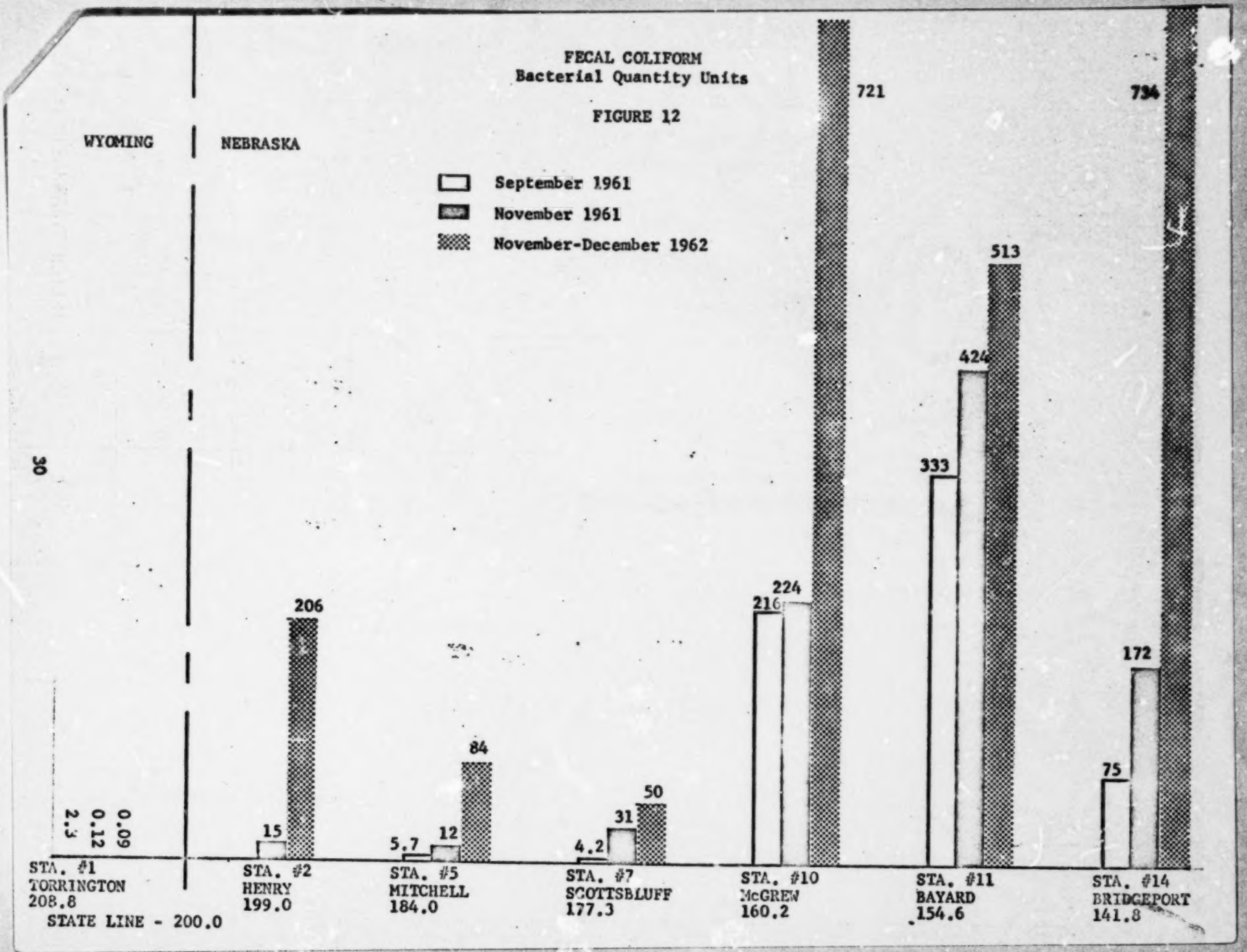
TABLE NO. V
BACTERIOLOGICAL RESULTS OF LABORATORY EXAMINATION
of
SUGAR BEET SAMPLES COLLECTED DECEMBER 1952

(Results are in counts/gram)

Location	Total Coliforms Confirmed	Total Coliforms Completed	Fecal Coliform	Fecal Streptococci
Beet Peelings				
Bayard	2,780,000	11,000	*2.0	100
Bayard	330,000	230,000	2.0	230,000
Torrington	54,200	1,300	*2.0	1,000
Torrington	160,000	160,000	*2.0	900
Beet Cores				
Bayard	*2.0	*2.0	*2.0	*10
Bayard	*2.0	*2.0	*2.0	*10
Torrington	8.0	8.0	*2.0	*10
Torrington	*2.0	*2.0	*2.0	*10
Beet Root Crevices				
Bayard	2,300,000	17,700	*2.0	5,600
Torrington	160,000	54,200	*2.0	9,800

* - Indicates "less than"


FECAL COLIFORM PER 100 ML.
(In Thousands)
FIGURE 11
September 1961
November 1961
November-December 1967
WYOMING
NEBRASKA
29
0.4
0.04
0.03
0.3
4.7
64.9
2.7
2.5
15.3
1.3
5.4
8.4
37
27.7
81.6
50
46
55.7
8.9
16.2
67.1
STA. #1
TORRINGTON
208.8
STATE LINE - 200.0
STA. #2
HENRY
199.0
STA. #5
MITCHELL
184.0
STA. #7
SCOTTSBLUFF
177.3
STA. #10
McGREW
160.2
STA. #11
BAYARD
154.6
STA. #14
BRIDGEPORT
141.8


FECAL COLIFORM
Bacterial Quantity Units
FIGURE 12
WYOMING
NEBRASKA
September 1961
November 1961
November-December 1962
90
2.3
0.12
0.09
206
15
5.7
12
84
4.2
31
50
216
224
721
333
424
513
75
172
734
STA. #1
TORRINGTON
208.8
STATE LINE - 200.0
STA. #2
HENRY
199.0
STA. #5
MITCHELL
184.0
STA. #7
SCOTTSBLUFF
177.3
STA. #10
McGREW
160.2
STA. #11
BAYARD
154.6
STA. #14
BRIDGEPORT
141.8

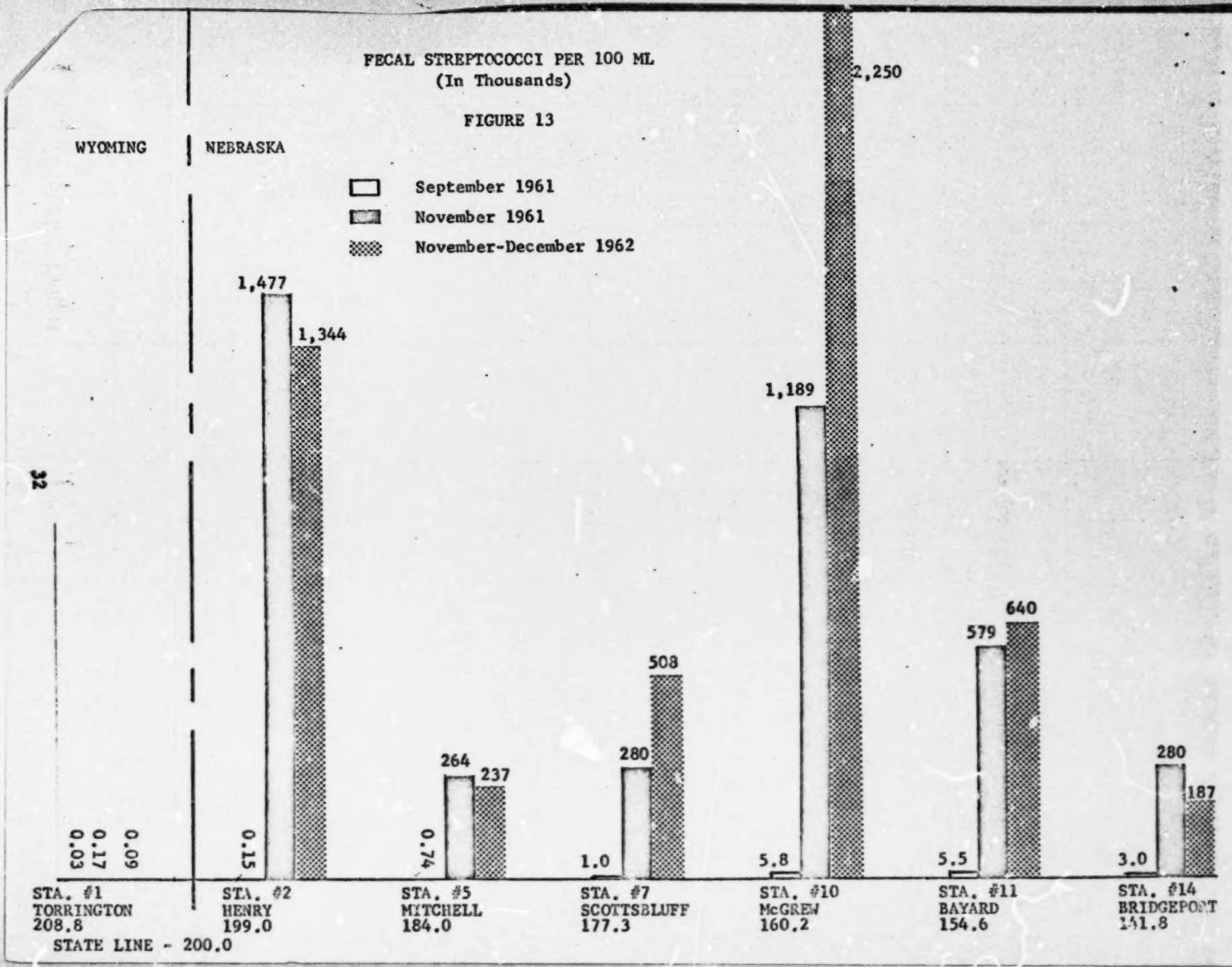
of November 1961 is some fifteen-fold. A rather rapid die-off of these organisms was noted in downstream stations to Station 10, where again a significant (approximately a three-fold) increase was noted. If the domestic wastes from the Holly Sugar Corporation plant and from the city of Torrington, Wyoming are not reaching the stream, and if the stream at Station 1 does not contain significant numbers of fecal coliform organisms, it must be assumed that these are coming from the Holly Sugar Corporation plant. Since no known domestic wastes are entering the stream, it is believed that the only source of the organisms is from the soil accompanying the beets to the flume water. Conditions in the flume water are probably conducive to rapid growth of the organisms subsequently found in the River.

Fecal streptococci in 1,000/100 ml are shown on Figure 13, and in bacterial quantity units in Figure 14. It is interesting to note that at Station 2, an average of 1,477,000 organisms per 100 ml were found in November 1961; and during the 1962 survey, an average of 1,344,000 per 100 ml were found. The reduction expected following in-plant modifications by the Holly Sugar Corporation plant did not materialize. At Station 7 the number noted almost doubled, and at Station 10 again a two-fold increase is noted. No explanation for the increase between Stations 7 and 10 is offered at this time.

Figures 15 and 16 were developed from data obtained by sampling the five beet sugar plant waste lines, and show the biochemical oxygen demand in mg/l and pounds per day respectively. Composite samples were collected daily for the seven-day period from each of the plant waste lines. At the Scottsbluff Great Western plant, samples were collected

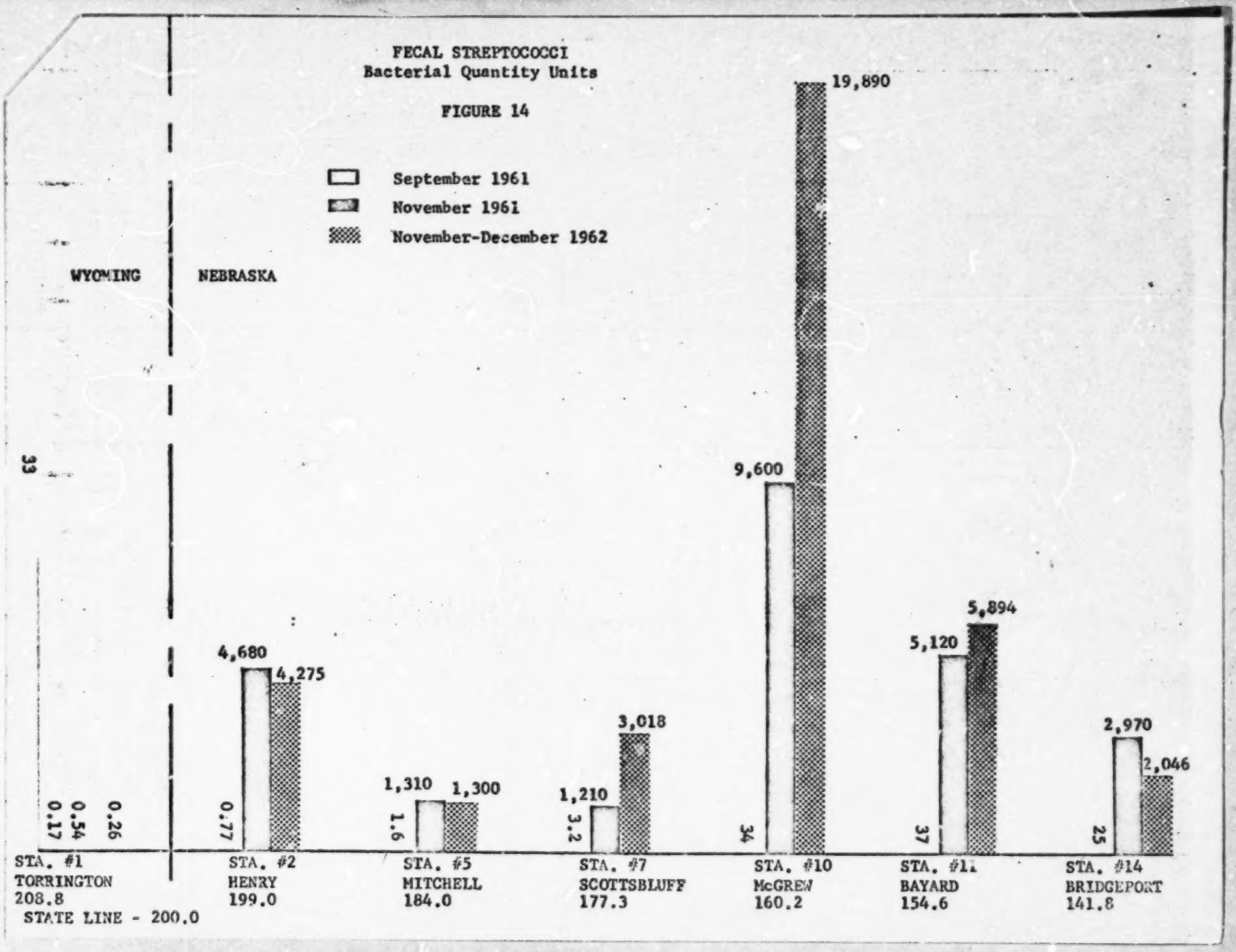
FECAL STREPTOCOCCI PER 100 ML
(In Thousands)

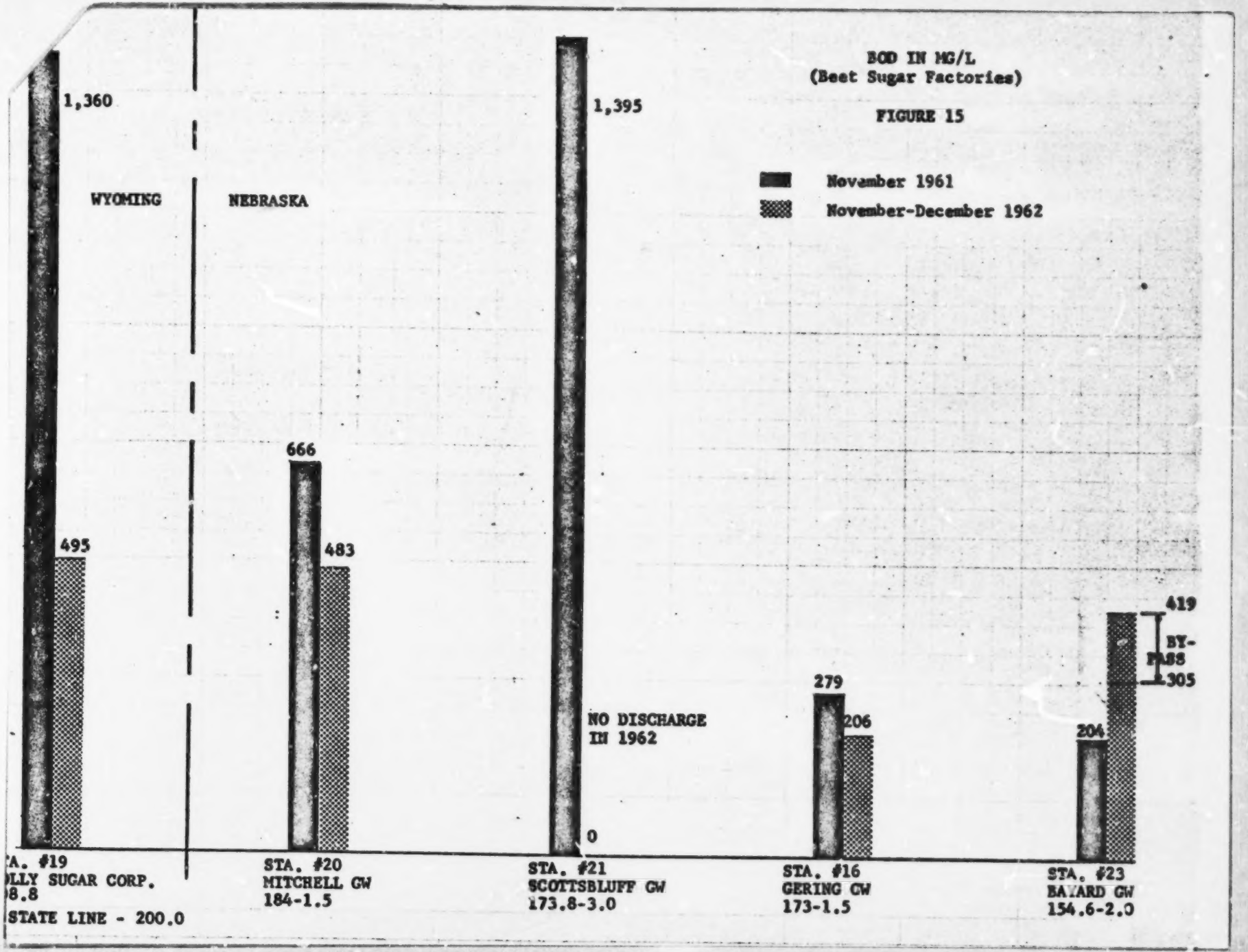
FIGURE 13

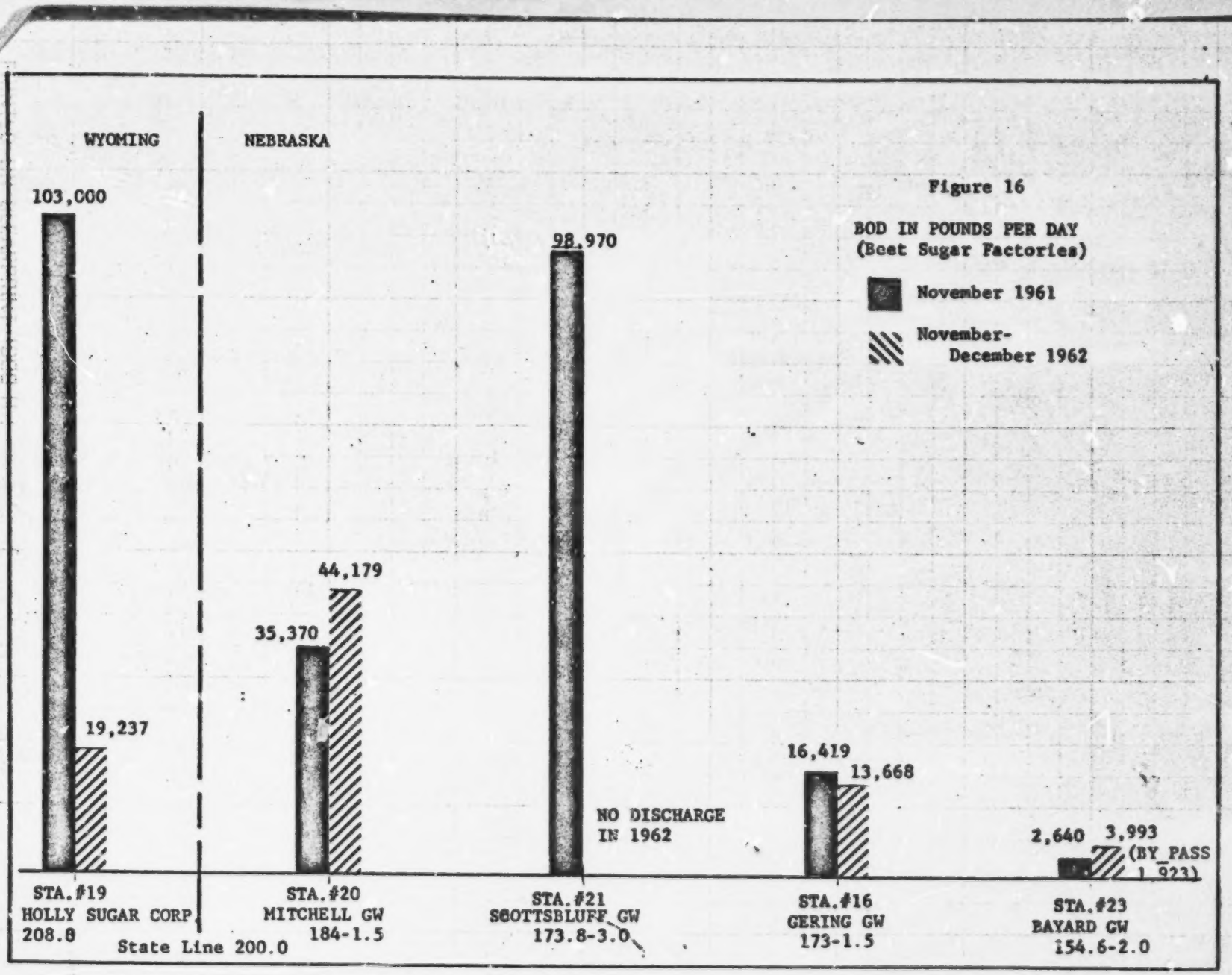


FECAL STREPTOCOCCI
Bacterial Quantity Units

FIGURE 14




BOD IN MG/L
(Beet Sugar Factories)
FIGURE 15
November 1961
November-December 1962
WYOMING
NEBRASKA
1,360
495
666
483
1,395
NO DISCHARGE
IN 1962
0
279
206
204
419
BY-
305
'A. #19
LLY SUGAR CORP.
8.8
STATE LINE - 200.0
STA. #20
MITCHELL GW
184-1.5
STA. #21
SCOTTSBLUFF GW
173.8-3.0
STA. #16
GERING GW
173-1.5
STA. #23
BAYARD GW
154.6-2.0


WYOMING
NEBRASKA
103,000
19,237
35,370
44,179
98,970
NO DISCHARGE
IN 1962
16,419
13,668
2,640
3,993
(BY PASS
1 923)
STA.#19
HOLLY SUGAR CORP
208.8
State Line 200.0
STA.#20
MITCHELL GW
184-1.5
STA.#21
SCOTTSBLUFF GW
173.8-3.0
STA.#16
GERING GW
173-1.5
STA.#23
BAYARD GW
154.6-2.0
Figure 16
BOD IN POUNDS PER DAY
(Beet Sugar Factories)
November 1961
November-
December 1962

at the point of discharge to the holding ponds. There was no discharge from the ponds. Samples were collected from the Great Western Bayard beet sugar plant waste system at two points - the treatment device influent and effluent. All samples were composite samples composed of three portions collected at approximately two-hour intervals, beginning at 8:00 a.m.

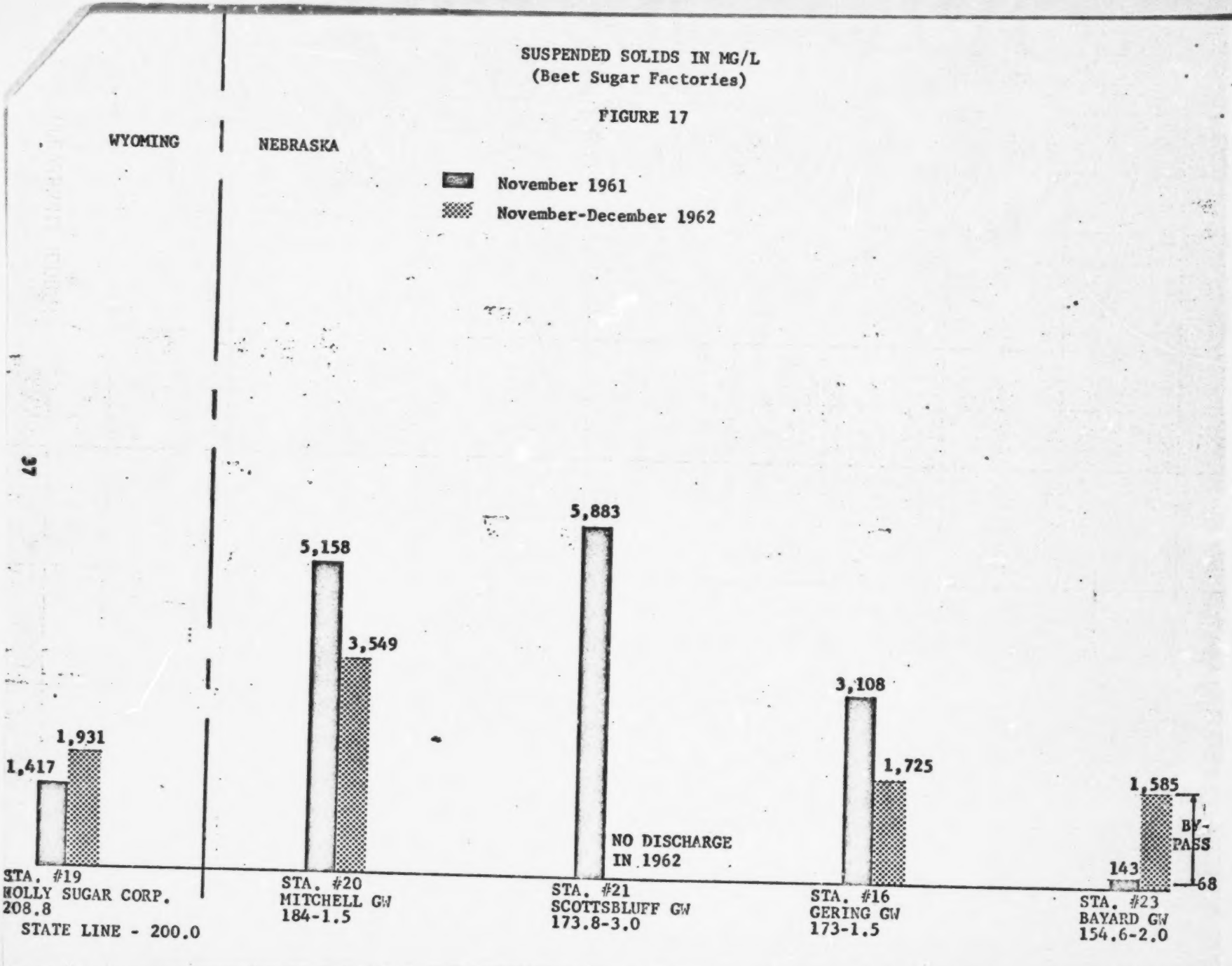
Figure 15 indicates that pollution abatement measures initiated by the Holly Sugar Corporation have effected a reduction of approximately 63 percent of the BOD concentration in mg/l. However, since the volume of wastes discharged by the plant was significantly reduced by in-plant modifications, total BOD in pounds per day discharged was decreased about 82 percent, as shown in Figure 16.

At Station 20, wastes from the Great Western sugar plant at Mitchell had a decrease in BOD concentration of approximately 28 percent, but the increased plant discharge resulted in an increase of BOD in pounds per day discharged to the stream of 25 percent. Discharge by the Great Western Scottsbluff plant was 0, a reduction of 98,970 pounds of BOD per day. The Great Western Gering plant showed a decrease in total pounds of BOD per day discharged to the river of approximately 16 percent.

The efficiency of the Great Western Bayard plant waste treatment facility was disappointing. The BOD of the waste discharged from the outlet of the holding pond increased from 204 mg/l in 1961 to 305 mg/l in 1962. However, total pounds of BOD discharged from the treatment device was reduced from 2,640 to 1,923, a decrease of approximately 27 percent. The lift station in this plant outfall line, which pumps waste from the outfall ditch to the treatment device is equipped with a

SUSPENDED SOLIDS IN MG/L
(Beet Sugar Factories)

FIGURE 17



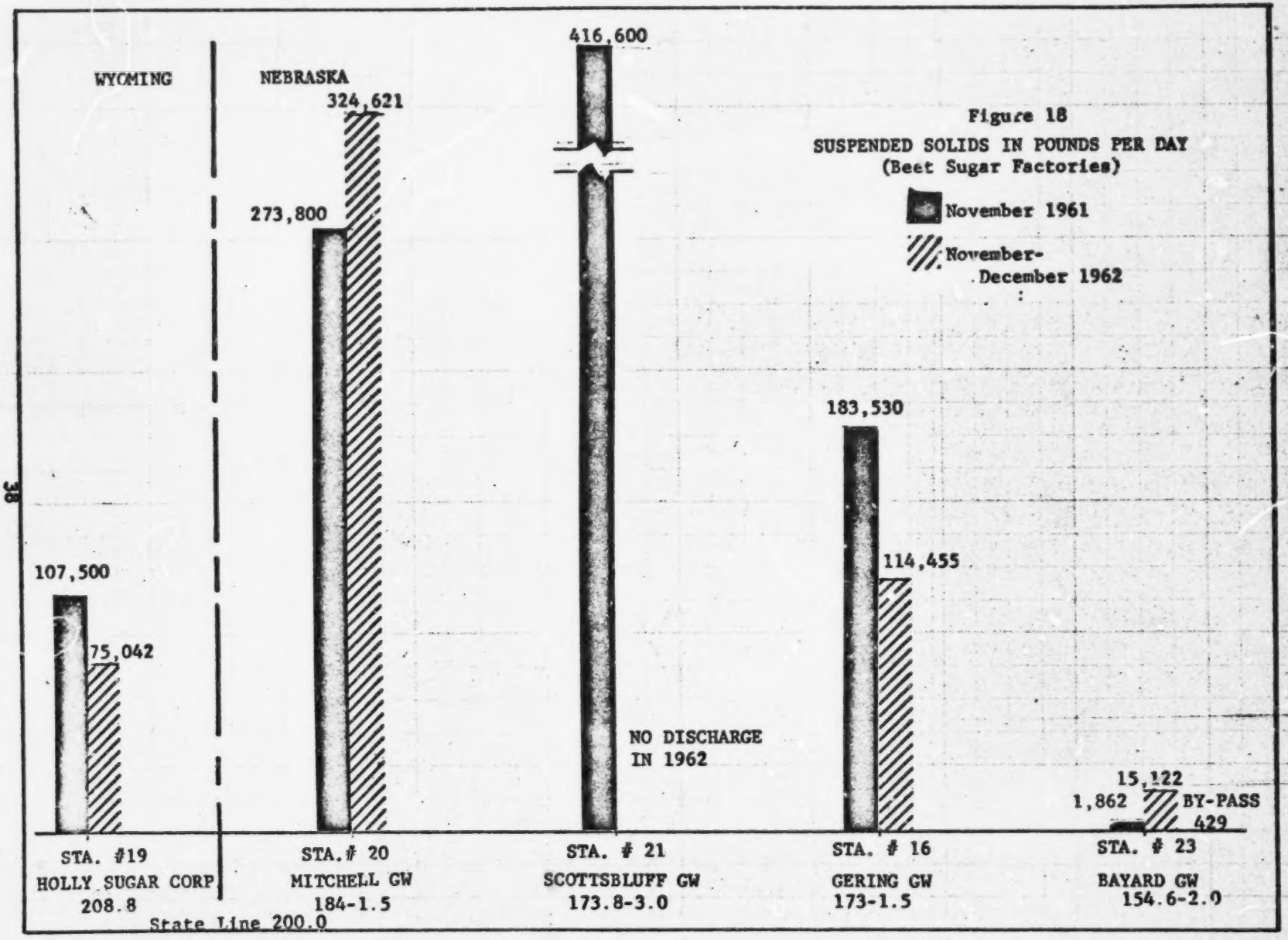


Figure 18

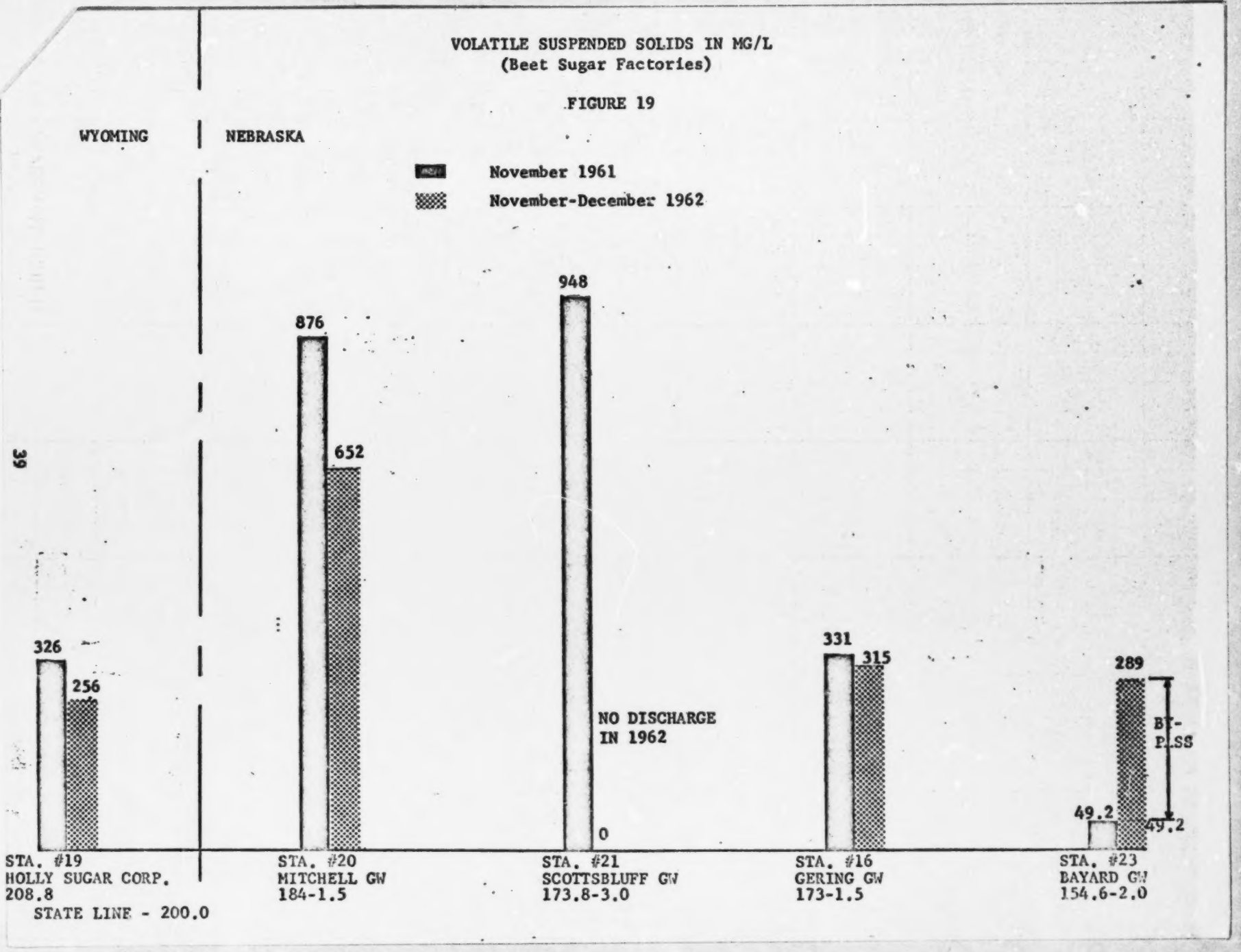
SUSPENDED SOLIDS IN POUNDS PER DAY
(Beet Sugar Factories)

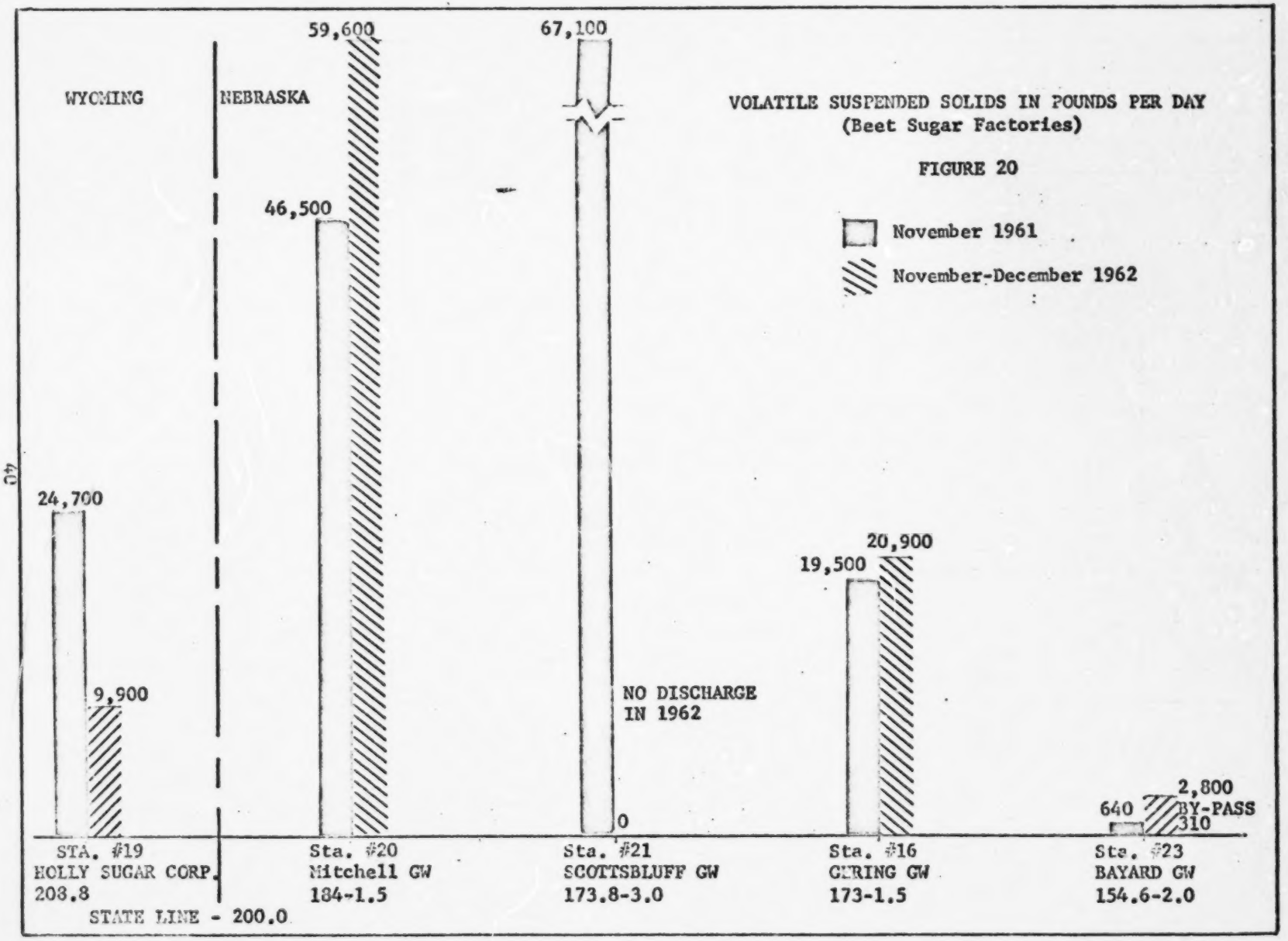
November 1961

November-
December 1962

VOLATILE SUSPENDED SOLIDS IN MG/L
(Beet Sugar Factories)

FIGURE 19




WYOMING
NEBRASKA
59,600
67,100
46,500
24,700
9,900
NO DISCHARGE
IN 1962
0
20,900
19,500
640
2,800
BY-PASS
310
VOLATILE SUSPENDED SOLIDS IN POUNDS PER DAY
(Beet Sugar Factories)
FIGURE 20
November 1961
November-December 1962
STA. #19
HOLLY SUGAR CORP.
208.8
Sta. #20
Mitchell GW
184-1.5
Sta. #21
SCOTTSBLUFF GW
173.8-3.0
Sta. #16
GERING GW
173-1.5
Sta. #23
BAYARD GW
154.6-2.0
STATE LINE - 200.0

by-pass arrangement. As has been previously noted, this by-pass was very nearly in continuous operation. The amount discharged varied somewhat but was carefully estimated to be approximately 8 percent of the average plant discharge. As can be noted in Figure 16, this by-pass accounted for an estimated 2,070 pounds per day BOD discharged, which was approximately 50 percent of the total BOD discharged to the River by the Bayard plant.

Figures 17 and 18 show the suspended solids in mg/l and in pounds per day respectively from each of the five beet sugar plants. Total suspended solids discharged from the Holly Sugar Corporation were 75,042 pounds per day, a decrease of approximately 30 percent. Total suspended solids discharged from the Great Western Mitchell plant increased from 273,800 pounds per day in 1961 to 324,621 in 1962, an increase of 18 percent. At Station 16, total suspended solids discharged by the Gering plant decreased from 183,530 pounds per day in 1961 to 114,455 in 1962, a decrease of 37 percent. The treatment device at the Bayard plant was apparently relatively efficient in removing suspended solids from the wastes, but the by-pass permitted large quantities to be discharged to the River, resulting in a total of 15,122 pounds per day of suspended solids in 1962.

The discharge of volatile suspended solids in mg/l and in pounds per day is shown in Figures 19 and 20. Total pounds discharged by the Holly Sugar Corporation decreased from 24,700 pounds per day in 1961 to 9,900 in 1962, a decrease of some 60 percent. The total pounds per day of volatile suspended solids discharged by the Mitchell plant increased 28 percent, while the Gering plant remained approximately

constant. Suspended solids discharged from the Bayard Great Western treatment device plus those contained in wastes by-passing the treatment device, were an estimated 2,800 pounds per day in 1962.

SUMMARY AND CONCLUSIONS

The Survey conducted by the Public Health Service and the States of Wyoming and Nebraska was initiated in accordance with Recommendation No. 7 of the Conferees at the second session of the Conference on Pollution of Interstate Waters of the North Platte River, Wyoming-Nebraska. The survey was planned by representatives of the States and the Public Health Service. Analyses to be performed were agreed upon and sampling points were selected to depict any material changes from previous surveys in the quality of water of the North Platte River.

Industries and municipalities alike along this reach of the River, from Torrington, Wyoming to Bridgeport, Nebraska, are exhibiting a very cooperative attitude toward providing adequate waste treatment facilities. The realization of the need for protecting this valuable water resource is apparent.

Prior to the beginning of the 1962 beet sugar campaign, the Holly Sugar Corporation completed the necessary in-plant modifications to remove all wastes from the River except flume water, and constructed holding ponds large enough to contain these wastes for the entire campaign. The capacity of screening equipment in the flume water waste line was materially increased to further reduce solids in wastes discharged to the River. However large quantities of wastes are still being discharged to the stream, as are heavy concentrations of bacteriological contamination.

It is reported that the Great Western Mitchell and Gering beet sugar plants have acquired sites for the construction of waste treatment facilities. The Scottsbluff plant has completed holding ponds to impound all wastes. The levees forming these ponds are of a temporary nature and several failures occurred during the 1962 campaign.

The Great Western Plant at Bayard remodeled its broad field irrigation system by constructing levees to form holding ponds. These levees were of a temporary nature and failed several times during the 1962 campaign. The lift station has not been modified to prevent significant quantities of waste from by-passing the treatment facility.

The municipality of Scottsbluff, Nebraska has completed waste treatment facilities which will accommodate all industrial wastes in the city. The municipal treatment facility was placed in operation late in December of 1962. The progress of other municipalities, with the exception of Bayard, Nebraska, is very commendable. Specific information is shown in Table IV.

Unusually high concentrations of coliform bacteria were found at all river stations below Torrington, Wyoming. The average total coliform count at the Wyoming-Nebraska State Line (Station 2, Henry, Nebraska) was 112,000/100 ml (Figure 9), which is some 22 times the 5,000/100 ml recommended by the Engineering Section, Missouri Basin Health Council[1/]. The average fecal coliform count at the State line was 64,900/100 ml (Figure 11) and the average fecal streptococci at this station was 1,349,000/100 ml (Figure 13).

1/ Appendix B

Wastes discharged to the River by the Holly Sugar Corporation continue to adversely effect the biota of the stream. However conditions were considerably improved over the preceeding year. The Holly Sugar Corporation waste load eliminated or markedly reduced the benthic population along the right bank of the river in reaches above river mile 199.5 as contrasted with significant reduction or eradication down to river mile 199 in 1962[1/].

Interstate pollution of the North Platte River is still occurring. While improvement is noted in the quality of water throughout the reach of the stream under consideration, it is evident that large quantities of waste and very high bacterial concentrations are still being discharged to the stream above the State line. Additional treatment of the Holly Sugar Corporation wastes will be required to eliminate interstate pollution and to restore the Wyoming reach of the North Platte River to the degree of water quality commensurate with water uses in that section of the stream. Proposed Nebraska improvements, when completed and properly operated, will eliminate pollution now evident below the State line, and restore the quality of the River to a point which is compatible with that which will be entering Nebraska from Wyoming.

RECOMMENDATIONS

1. That the Holly Sugar Corporation provide additional treatment facilities to further decrease wastes and bacterial concentrations being discharged to the North Platte River.

2. That the construction of treatment facilities at the Great

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1/ See Section II of this report.

Western Mitchell plant be completed and the facility ready for operation as soon as possible.

3. That the levees impounding the Great Western Scottsbluff plant wastes be made into permanent structures to eliminate accidental discharge of wastes to the stream.

4. That plans for constructing treatment facilities at the Great Western Gering plant proceed as rapidly as possible.

5. That the poorly constructed levees now forming impoundments at the Great Western Bayard plant be made into permanent levees, and further, that the waste pumping station be modified so as to preclude the possibility of untreated wastes by-passing the treatment facility.

6. That municipality of Bayard, Nebraska proceed with the construction of adequate waste treatment facilities.

7. That the State of Nebraska continue its present aggressive policy regarding the construction of municipal and industrial waste treatment facilities along this reach of the North Platte River.

8. That a meeting be arranged to discuss the progress to date in pollution abatement on the North Platte River. The meeting should be constituted of the same agencies and industries that planned the Monitoring Program.

9. That a survey similar to the one completed in 1962 be conducted during the 1963 beet sugar campaign.

SECTION II

Biological

Biological Effects of Wastes Discharged to the North Platte River, Torrington, Wyoming - Bridgeport, Nebraska November 14 and 15, 1962

Joe K. Neel
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Water Supply and Pollution Control Program
U. S. Public Health Service, Region VI
Kansas City, Missouri

Collections and observations in 1962 were made at most localities selected in 1960 and 1961 (Table 1). Access to desired sampling areas was denied by deep water in alongshore channels at Station 9 and a drop in water level exposed all benthic habitat areas at Station 5. The area below the bridge at McGrew was substituted for Station 9.

General Appearance

Clear water passing under the Torrington, Wyoming bridge (Station 1) was still discolored along the right bank by turbid wastes leaving the beet plant outfall. These discharges lacked the foam and beet particles that were salient items during the 1960 and 1961 beet campaigns. The right half of the river alone remained muddied downstream past Station 2-R, but wastes spread to encompass the entire river width shortly above Station 3. Stations 3, 4, 5, and 6 were noticeably less turbid than during November 1960 or 1961. Turbidity increased at Station 7 and again at Station 8, and remained near the latter level past Station 10 (Bridgeport). Concentration at all stations was obviously below 1961 levels. Accumulations of beet debris were nowhere noticeable, but cossettes and pulp fibers were recovered, at all stations sampled, except 1 and 2L, from masses of flotsam and jetsam caught on driftwood, fences, bridge piers, etc.

NORTH PLATTE RIVER

Table 1. Biological Sampling Sites 1962

STATION	LOCATION	RIVER MILE ABOVE MOUTH
1	Torrington, Wyoming	208.5
2-L	Left side of River, 1 mile below Station 1	207.5
2-R	Right side of River, at above point	207.5
3	Gering-Mitchell Diversion Dam - Wyoming	198.5
4	Henry, Nebraska	189
6	Mitchell, Nebraska	184.7
7	West Scottsbluff, Nebraska Bridge	178
8	Minatare-Melbeta Bridge	165.5
-	McGrew, Nebraska	160.2
10	Bridgeport, Nebraska	141.5

Station 9, Bayard, Nebraska, mile 154.6, not used.

Waste solids settled on the bottom in appreciable quantities along the right half of the river from the Torrington beet plant outfall to some distance below Station 2-R. At 2-R, the bottom was covered with sludge and silt from the right shore to past midstream. The thin gray upper layer of this deposit covered a black stratum two to four inches thick. At Station 3, the upstream face of the dam bore blankets of sludge, but bottom in all other areas at that locality was sand or sand and rocks. Sand was the only bottom material observed at Stations 4 and 5, but silt and sludge accumulations were noted atop sand along the right bank at Stations 6 and 7. Bottom could not be observed at Station 8. Sand was the only component noted at McGrew and Station 10. Driftwood, pieces of fence, weeds and other materials anchored in the sand, and debris caught on such obstructions, were the principal habitats of algae and bottom animals below Station 2-L.

Algae and Slime Growths

Sphaerotilus formed a pinkish waving blanket over large areas of the sludge deposited along the right half of the stream bed at Station 2-R. It occurred in scattered patches at Station 3 and in sparse amounts intermixed with benthic algae at Stations 3 and 4. It was not recovered below Station 4. (Table 2).

Composition of benthic algal growths sampled at each station also appears in Table 2. The most abundant widespread species, Diatoma vulgare, invested other algae, weeds and grasses, and various other submerged substrates. Cladophora formed rather luxuriant growths at Stations 1, 2-L, 10 and at McGrew. Red algae (Compsopogon) occurred as widely scattered small saccate growths that bore very few short fila-

Table 2 Benthic Algae - North Platte River - November 14-15, 1962

Station number	1	2L	2R	3	4	6	7	8	McGrew	10
Green Algae										
Cladophora sp.	+	+		+	+	+	+	+	+	+
Closterium sp.	+			+		+				
Cosmarium sp.	+									
Microspora sp.	+	+		+						
Oedogonium	+									
Pediastrum integrum		+		+						
Scenedesmus armatus		+								
Spirogyra				+					+	
Diatoms										
Amphora sp.	+									
Cocconeis pediculus	+	+		+			+	+	+	
Cymatopleura solea	+			+	+					
Cymbella aspera	+	+		+		+	+			
Cymbella sp.	+	+		+	+	+	+		+	
Diatoma vulgare	+	+		+	+	+	+	+	+	+
Gomphonema sp.		+		+			+		+	
Gyrosigma										+
Mastogloia smithii	+	+		+	+	+	+		+	+
Melosira granulata		+		+		+		+		
Navicula cuspidata	+			+		+		+	+	
Nitzschia elongata	+	+		+	+	+	+	+	+	+
Nitzschia sigmoidea	+			+			+			
Pleurosigma delicatulum	+	+		+		+	+			
Stauroneis sp.							+			
Stephanodiscus astraea	+									
Surirella sp.				+	+	+			+	+
Synedra amphicephala		+		+		+	+			
Blue-green Algae										
Chroococcus sp.	+									
Phormidium sp.	+	+	+	+					+	
Merismopedia elegans	+	+								
Euglenophyta										
Euglena sp.		+		+						
Red Algae										
Compsopogon sp.	+	+				+	+			
Sphaerotilus			+	+	+					

ments. Diatoms other than Diatoma vulgare, Cocconeis, Synedra amphicephale (which were attached to other algae, grasses, weeds, etc.) were components of brown gelatinous layers on sand, driftwood, and stones. Chroococcus, Morismopedia, and Euglena occurred in the interstices of green algae and filamentous diatoms. Phormidium formed small scattered dark blue-green patches.

At Station 1, green algae (Cladophora and Gedogonium) were largely concentrated on the riffle near the right bank below the coffer dam and caught on driftwood along the lip of the dam. Floating fronds frequently drifted over the sandy area above the dam. Brown diatom layers covered large areas of sand and gravel bottoms under the bridge and floating patches of such growths dislodged from upstream sites were common. Diatoma was attached to other algae and smaller pieces of driftwood. At Station 2-L, the gravel and sandy bottom was largely covered with green algae that were very densely invested with Diatoma, Synedra, and Cocconeis. A few scattered areas bore brown plate-like layers of other diatoms. At Station 2-R, the Sphaerotilus carpet contained a few scattered blue-green tufts of Phormidium. Bottom at Station 3 bore widely dispersed clumps of Sphaerotilus. Algae grew there on sand, on sticks and other detritus caught in sand, on rocks near the dam, and on the walls of the control channel and ditch control gate. Patches of diatom jellies were common on stable sand along the left shore. At Station 4, the most conspicuous algal growths were attached to driftwood, but some diatom films were seen on the sandy bottom near the right bank. Algae were rather scarce at Station 6. Some diatom films occurred at the bottom in shallow areas, and Diatoma and other diatoms invested some sticks and grasses. Green

algae (Cladophora) formed very minute portions of attached growths. Coontail (an aquatic flowering plant) was recovered from debris accumulations.

At Station 7, green algae were somewhat more numerous than at Station 6. Diatoma and its associates occurred with the green algae and other diatoms formed brown gelatinous films on stable bottom areas and logs and planks comprising a driftwood accumulation at the bridge. At Station 8, algae, (green algae and diatoms) occurred only on driftwood and other detritus. None were attached to bottom or bridge piers and the suspicion arises that algae noted on obstructions there had not developed on such sites but had recently been stranded as they floated downstream. Pieces of coontail were also present in accumulated debris. At McGrew the bottom had been disturbed to a considerable extent by dredging and filling concomittant to construction of a new bridge, but numerous waving algal fronds were attached to detritus caught on various anchored pieces of wood, weeds, wires, etc. At Station 10, algae grew on sticks, boards, and debris caught on obstructions beneath the bridge, and on submerged grasses along the shore. Diatoma was especially conspicuous on the grasses.

In November 1960, algae disappeared at Station 3 and were absent from there down to Mitchell, where collections stopped. In October and November, 1961, benthic algae were found at Stations 1, 2-L, 4, 6, 7, and 9. Sphaerotilus occurred at all stations except 1 in 1961 and was the only growth present at 2-R, 3, and 8. Turbidity appeared lower in the fall of 1961 than during the 1960 beet campaign.

Benthic Animals

At Station 1, habitat for this group consisted of various sized stones, driftwood tangles, and debris caught on various obstructions. At 2-L, they lived among gravel and small stones and on driftwood and its accumulated debris. At all other stations organisms were found only on driftwood and debris accumulations.

Distribution of various bottom dwelling animals found in November 1962, is shown in Table 3. The maximum number of species (20) occurred at Station 1. No organisms were found at 2-R, but decimation in number of forms was otherwise not very marked until Station 6, where only seven occurred. Caddis flies (Trichoptera) and stone flies (Plecoptera) appeared least tolerant of the waste components discharged at Torrington and below. Appearance of the stone fly (Allocapnia) at Station 10 could possibly be interpreted to indicate some degree of recovery, although the number of species had not increased over that noted at McGrew and Station 8. Pollutional effects were seemingly most pronounced at Station 7 where only 4 different organisms occurred.

In the fall of 1960, benthic animals were eliminated from the right half of the stream bed from the Torrington outfall down to Station 3 and from the entire stream bed from Stations 3 and 6. In 1961, beet wastes eradicated this class of organisms at Stations 2-R, 4, and 8 before November 1 (the beet campaign began around October 1) and numbers of organisms were severely reduced at most other stations before October 31. The following table indicates the number of survivors at each station each year.

Table 3 Individual Benthos Analyses on North Platte River - November 1962

Station Number	1	2	3	4	6	7	8	9	10
PLATYHELMINTHES									
Dugesia sp.	x			x					
ANNELIDA									
Tubificidae							x		
Placobdella ornata (Verrill)				x					
MOLLUSCA									
Gastropoda									
Physa sp.			x	x		x			
CRUSTACEA									
Amphipoda									
Hyalella azteca				x	x	x	x		x
Isopoda									
Asellus militaris							x	x	x
INSECTA									
Plecoptera									
Allocapnia mystica Frison									x
Isoperla sp.	x	x	x						
Ephemereptera									
Centroptilium sp.		x							
Ephemerella excrucians	x	x	x	x				x	
Heptagenia diabasia	x	x	x	x	x	x	x	x	x
Heptagenia flavescens	x								
Heptagenia marginalis		x	x	x					
Heterocloen sp.		x	x	x	x		x	x	x
Leptophlebia sp.	x		x	x					
Tricorythodes sp.		x	x		x				
Odonata									
Argia sp.	x								
Hetaerina sp.	x		x						
Ophiogomphus sp.	x	x							
Hemiptera									
Ambrysus mormon montadon	x	x	x						
Lethocerus americanus									x
Trichoptera									
Hydropsyche sp. 1	x	x	x	x					
Hydropsyche sp. 2	x								
Coleptera									

Table 3 Individual Benthos Analyses on North Platte River - November 1962

Station Number	1	2	3	4	6	7	8	9	10
Gyrinus sp.	x								
Diptera									
Calopsectra sp.	x	x		x					
Chironomus militaris Joh.					x				
Cricotopus exilis Joh.								x	
Cricotopus (Group C - Edwards)				x					
Diamesia nivoriunda				x					
Diamesia sp.		x	x						
Glyptotendipes senilis		x				x			
Pentaneura flavifrons gr.		x							
Similium sp.	x	x	x	x	x		x	x	x
Spaniotoma (O.) obrumbrata Joh.	x	x	x	x					
Spaniotoma (O.) nivoriunda	x	x	x		x		x	x	
Spaniotoma sp.	x								
Tipula sp.	x								
NEMATODA SP.	x	x							

Station	No. Forms 1961 (Oct 31-Nov 2)	1962 (Nov 14-15)
1	23	20
2-L	17	18
2-R	0	0
3	4	15
4	0	15
6	7	7
7	4	4
8	0	7
McGrew	-	7
9	1	-
10	6	7

Conditions were considerably improved from the benthos viewpoint in 1962. The Torrington waste load eliminated or markedly reduced the population along the right bank only in reaches above Station 3 as contrasted with significant reduction or eradication down to Station 4 in 1961. Wastes discharged from the Mitchell beet plant had adverse effects at the West Scottsbluff bridge (Station 7) each year, but reductions in the waste load from the Scottsbluff beet plant in 1962 were seemingly responsible for survival at Station 8 of a number of forms that perished there during the 1961 beet campaign. It is assumed that survival in reaches between Stations 8 and 10 was also enhanced by wastes reduction effected at Scottsbluff. Discharge from the treatment area at the Bayard beet plant was clear and apparently lacked sphaerotilogenic materials on November 15, 1962.

Greater survival of benthic algae and animals and decreased production of Sphaerotilus in 1962 appeared to be directly related to decreased waste loads leaving the Torrington and Scottsbluff beet factories. Conditions in the river reach below the Mitchell beet plant allowed about the same degree of organisms survival as was noted in

1961, and it would appear that no improvement in waste removal was realized at that plant. Biological resources of the river still suffered deleterious effects traceable to beet plant discharges. Conditions were much improved at the Wyoming-Nebraska boundary; and the most undesirable conditions were promoted by discharges from beet plants located in Nebraska.

ACKNOWLEDGEMENT:

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APPENDIX A

NORTH PLATTE RIVER SURVEY
WYOMING - NEBRASKA
SEPTEMBER & NOVEMBER 1961
RESULTS OF ANALYSES
STATION 1 (MP208.8)

Month	Date	Sample Time	Temp °C	D.O. mg/l	B.O.D. mg/l	Susp. Solids mg/l	Volatile Susp. Solids mg/l	pH	Alkal. Phenol mg/l (as $CaCO_3$)	Alkal. Total mg/l (as $CaCO_3$)	Cl⁻ mg/l	Hard. mg/l	Ca. mg/l	Mg. mg/l	Specf. Conduct. µmhos/cm.	True Color Units	Turb. Units	Coli. M.P.N. Per 100 ml.	Fecal Coli M.P.N. Per 100 ml.	Fecal Strep. Per 100 ml.
9	22	08 00A	10	8.58	1.22	25.0	6.0	8.0	0	184	17.1	306	200	106	666	8	*25			50
9	23	11 15A	12	9.23	1.16	19.0	15.0	8.3	0	187	17.3	310	203	107	657	8	*25	3,300	2,300	38
9	24	07 50A	10	8.71	0.96	22.0	4.0	8.1	0	182	16.9	302	200	102	690	8	*25	1,300	*200	75
9	25	10 00A	12	9.30	1.29	15.5	5.5	8.1	0	195	16.1	298	203	95	705	5	*25	50	20	17
9	26	11 45A	14	9.10	2.67	14.5	9.5	8.2	0	196	14.2	298	215	83	725	5	*25	40	*20	4
9	27	11 25A	15	9.34	1.83	17.0	11.0	8.2	0	206	16.3	300	204	96	720	8	*25	130	20	22
9	28	08 30A	10	8.98	1.30	11.5	0.0	8.1	0	197	16.4	301	204	97	720	8	*25	80	70	19
AV			12	9.03	1.50	17.6	7.3	8.1	0	192	16.2	302	204	98	697	7	*25	800	*438	32
11	07	07 40A	04	10.23	0.95	19.6	9.6	8.1	0			306			690	7	*25	80	50	70
11	08	11 03A	06	11.10	1.00	5.6		8.2	0			299			725	8	*25	70	20	50
11	09	06 50A	04	9.78	1.41	21.2	1.6	8.1	0	176		306			705	7	*25	110	50	43
11	10	10 30A	07	10.54	0.80	6.0	2.0	8.3	0	174		298			741	4	*25	*20	*20	48
11	11	06 35A	05	9.39	1.07	4.4	4.0	8.1	0	175		304			700	7	*25	20	*20	108
11	12	10 00A	06	10.71	1.12	10.0	4.8	8.2	0	176		302			666	7	*25	50	50	38
11	13	07 00A	04	10.18	1.00	8.8	0.4	8.1	0	176		300			770	7	*25	70	20	240
11	14	10 25A	04	11.21	0.83	3.2	2.8	8.1	0	174		300			752	7	*25	70	*20	44
11	15	07 05A	04	10.00	0.50	5.7	4.0	8.0	0	176		297			705	7	*25	80	50	124
11	16	03 35P	05	12.00	1.51	4.4	4.4	8.2	0	170		292			690	7	*25	*20	*20	26
11	17	12 50P	04	11.57	0.91	6.5	6.5	8.0	0	174		297			668	7	*25	50	*20	1,200
11	18	09 30A	04	10.89	1.11	9.7	6.3	8.1	0	174		300			690	7	*25	80	*20	150
11	19	03 15A	03	10.10	1.00	9.0	9.0	8.1	0	173		297			741	3	*25	50	50	102
11	20	05 10A	01	10.58	0.95	10.7	10.7	8.1	0	174		299			683	7	*25	110	20	140
AV			4	10.6	1.0	8.9	5.1	8.2	0	174		300			710	7	*25	70	39	170

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11	30	08 30A		9.57	3.0	8	2											50	20	106
12	1	08 15A		9.10	2.2	46	8											*20	*20	74
12	2	08 30A		10.31	1.4	95	14											20	*20	42
12	3	08 15A		9.70	2.4	10	2											50	50	64
12	4	08 25A		10.40	1.4	6	4											-	-	-
12	5	08 20A		11.02	1.2	6	3											170	70	68
12	6	07 10A		10.40	3.0	4	4											20	*20	206
AV				10.1	2.09	25	5.29											55	33.3	93.

* INDICATES LESS THAN

NORTH PLATTE RIVER SURVEY
WYOMING - NEBRASKA
SEPTEMBER & NOVEMBER 1961
RESULTS OF ANALYSES

STATION 2 (NP199.0)

Month	Date	Sample Time	Temp. °C	D.O. mg/l	B.O.D. mg/l	Susp. Solids mg/l.	Volatile Susp. Solids mg/l	pH	Alkal. Phenol mg/l (as $CaCO_3$)	Alkal. Total mg/l (as $CaCO_3$)	Cl^- mg/l	Hard. mg/l	Ca. mg/l	Mg. mg/l	Specf. Conduct. µmhos/cm.	True Color Units	Turb. Units	Coli. M.P.N. Per 100 ml.	Fecal Coli M.P.N. Per 100 ml.	Fecal Strep. Per 100 ml.
9	22	08 30A	10	8.95	1.41	27.0	4.0	8.0	0	196	18.4	298	196	102	700	9	30			470
9	23	10 35A	11	9.41	1.09	30.0	16.0	8.2	0	198	18.0	305	188	117	680	9	25	1,400	200	120
9	24	08 20A	10	8.99	1.24	25.0	4.0	8.2	0	194	17.7	302	188	114	715	10	30	10,900	1,400	290
9	25	10 25A	11	9.69	2.11	17.5	6.5	8.1	0	206	17.5	299	203	96	752	6	*25	1,300	*200	46
9	26	12 10P	14	9.60	2.39	19.5	10.5	8.2	0	214	19.8	302	198	104	764	8	*25	330	80	20
9	27	11 55A	14	9.81	1.54	29.0	22.0	8.3	0	213	17.1	304	197	107	752	7	*25	230	80	8
9	28	08 50A	10	9.34	1.25	10.0	5.5	8.3	0	213	17.3	301	156	145	770	9	*25	1,720	130	74
AV			11	9.39	1.6	22.6	9.7	8.1	0	204	17.9	301	186	112	733	8	*26	2,600	*348	146
11	07	08 20A	4	8.38	52.4	56.	22.	7.9	0			300			740	16	40	130,000	11,000	1,700,000
11	08	10 32A	6	8.50	41.1	63.	25.	8.0	0			304			834	13	35	221,000	3,300	390,000
11	09	07 20A	4	7.75	44.5	96.	31.	7.9	0	197		302			775	13	40	240,000	7,000	3,300,000
11	10	09 00A	6	7.60	47.1	43.	5.	8.0	0	196		299			832	13	40	172,000	2,000	1,500,000
11	11	07 05A	6	6.42	52.9	55.	28.	7.9	0	197		300			769	14	55	278,000	2,000	2,300,000
11	12	09 35A	6	7.89	49.7	60.	24.	8.0	0	196		302			769	16	45	141,000	8,000	3,400,000
11	13	07 30A	4	8.21	44.6	61.	21.	8.0	0	197		293			848	14	50	79,000	2,000	400,000
11	14	09 35A	4	8.51	44.7	71.	27.	7.8	0	196		300			763	13	65	175,000	2,000	940,000
11	15	07 35A	4	7.90	55.4	59.	27.	7.9	0	196		295			807	13	45	130,000	*2,000	600,000
11	16	3 00P	4	8.90	61.2	76.	37.	8.0	0	200		296			790	13	55	33,000	*2,000	260,000
11	17	01 20P	4	8.64	61.8	49.	28.	7.8	0	199		301			770	13	45	172,000	8,000	340,000
11	18	09 00A	3	8.54	46.8	90.	37.	7.8	0	198		300			690	14	40	490,000	*2,000	1,250,000
11	19	03 40A	3	8.01	46.6	85.	54.	7.8	0	199		294			840	14	50	49,000	2,000	8,000
11	20	04 40A	1	8.41	75.4	74.	44.	8.0	0	194		297			683	14	55	330,000	*2,000	3,500,000
AV			4	8.1	48.4	67.0	29.2	7.9	0	197		298			779	14	47	88,571	4,730	1,477,142

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11	30	09 00A		9.24	56.4	42	11											23,000	5,000	960,000
12	1	08 45A		9.85	42.4	57	15											79,000	49,000	4,200,000
12	2	09 00A		10.02	10.0	51	18											79,000	33,000	1,130,000
12	3	09 00A		9.30	13.0	35	10											109,000	49,000	520,000
12	4	08 55A		10.24	18.5	33	15											79,000	79,000	830,000
12	5	08 55A		10.93	17.1	34	9											172,000	109,000	820,000
12	6	07 30A		10.08	15.4	38	12											240,000	130,000	950,000
AV				9.96	24.69	41.4	12.9											111,571	64,857	1,344,286

* INDICATES LESS THAN

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NORTH PLATTE RIVER SURVEY
WYOMING - NEBRASKA
SEPTEMBER & NOVEMBER 1961
RESULTS OF ANALYSES

STATION 5 (NP184)

Month	Date	Sample Time	Temp. °C	D.O. mg/l	B.O.D. mg/l	Susp. Solids mg/l	Volatile Susp. Solids mg/l	pH	Alkal. Phenol mg/l (as $CaCO_3$)	Alkal. Total mg/l (as $CaCO_3$)	Cl⁻ mg/l	Hard. mg/l	Ca. mg/l	Mg. mg/l	Spec. Conduct. µmhos/cm.	True Color Units	Turb. Units	Coli. M.P.N. Per 100 ml.	Fecal Coli M.P.N. Per 100 ml.	Fecal Strep. Per 100 ml.
9	22	10 00A	10	8.89	1.69	38.0	14.0	8.1	0	307	22.1	258	158	100	869	12	60			1,360
9	23	09 15A	11	9.37	1.18	19.0	11.0	8.1	0	310	21.7	267	118	149	840	14	25	17,200	4,900	900
9	24	09 25A	10	8.52	1.25	26.0	7.0	8.0	0	292	19.6	280	155	125	847	8	25	13,000	7,900	570
9	25	11 40A	14	10.13	2.43	20.0	9.0	8.2	0	291	21.0	278	192	86	901	9	25	1,300	500	90
9	26	01 20P	15	9.66	3.07	384.	46.	8.4	1.8	254	19.3	283	210	73	820	14	50	1,300	220	160
9	27	01 00P	15	9.53	2.94	41.0	8.0	8.4	2.0	256	19.3	278	193	85	820	12	35	10,900	490	280
9	28	09 50A	12	9.10	1.71	56.0	5.0	8.2	0	257	19.2	277	183	94	827	12	45	3,480	2,400	860
AV			12	9.45	2.04	83.4	7.4	8.2	0	241	20.3	287	172	101	846	11	37	7,900	2,700	740
11	07	09 30A	5	8.90	34.9	45.	17.	8.0	0			291			720	13	30	79,000	11,000	212,000
11	08	09 00A	4	8.83	14.2	50.	23.	8.1	0			293			626	13	30	49,000	•2,000	150,000
11	09	08 40A	5	8.40	16.1	188.	11.	8.0	0	208		290			775	12	30	33,000	1,400	130,000
11	10	07 45A	6	7.98	11.5	172.	20.	8.0	0	207		290			855	12	35	79,000	2,300	270,000
11	11	08 25A	6	7.90	16.8	47.	15.	8.0	0	206		289			769	12	30	79,000	500	220,000
11	12	08 15A	6	8.11	17.	51.	42.	8.0	0	206		289			781	11	25	240,000	2,300	450,000
11	13	08 55A	5	8.69	14.8	225.	20.	8.0	0	206		286			840	13	25	221,000	800	160,000
11	14	08 10A	3	8.87	14.6	57.	22.	8.0	0	206		288			769	8	35	70,000	800	490,000
11	15	09 05A	4	8.60	15.8	62.	32.	7.9	0	202		290			807	12	30	33,000	4,900	128,000
11	16	01 45A	4	9.39	24.4	139.	37.	7.9	0	207		287			819	12	75	79,000	800	200,000
11	17	02 45P	4	8.99	25.8	101.	26.	7.9	0	208		292			781	13	60	109,000	1,300	470,000
11	18	07 35A	3	8.96	20.6	129.	20.	7.9	0	206		287			807	12	40	109,000	800	620,000
11	19	04 50A	3	8.66	22.7	145.	36.	7.9	0	208		289			825	9	70	172,000	2,300	106,000
11	20	03 30A	3	8.68	25.9	98.	28.	8.0	0	208		290			787	14	45	70,000	2,700	90,000
AV			4	8.7	19.65	107.8	26.4	8.0	0	206		289			797	12	40	101,571	2,453	264,000

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11	30	09 45A		9.51	13.2	80	12													
12	1	09 30A		9.62	8.0	56	11											33,000	17,000	210,000
12	2	09 45A		10.18	2.3	80	14											13,000	7,900	330,000
12	3	09 30A		9.53	2.8	45	10											17,200	3,300	210,000
12	4	09 40A		10.21	2.4	43	17											10,900	4,900	120,000
12	5	09 35A		10.82	3.5	69	12											23,000	7,900	250,000
12	6	08 00A		10.13	5.0	65	15											49,000	17,200	300,000
AV				10.0	5.31	62.6	13											79,000	49,000	240,000
																		32,157	15,314	237,143

• INDICATES LESS THAN

NORTH PLATTE RIVER SURVEY
WYOMING - NEBRASKA
SEPTEMBER & NOVEMBER 1961
RESULTS OF ANALYSES
STATION 7 (KP177.3)

Month	Date	Sample Time	Temp. °C.	D.O. mg/l	B.O.D. mg/l	Susp. Solids mg/l	Volatile Susp. Solids mg/l	pH	Alkal. Phenol mg/l (as $CaCO_3$)	Alkal. Total mg/l (as $CaCO_3$)	Cl⁻ mg/l	Hard. mg/l	Ca. mg/l	Mg. mg/l	Specf. Conduct. µmhos/cm.	True Color Units	Turb. Units	Coli. M.P.N. Per 100 ml.	Fecal Coli M.P.N. Per 100 ml.	Fecal Strep. Per 100 ml.
9	22	12 05P	10	9.68	1.65	19.0	2.0	8.1	0	280	21.4	298	206	92	800	15	#25			1,900
9	23	07 30A	10	8.97	1.67	52.0	21.0	8.1	0	281	21.0	298	198	100	812	13	45	24,000	2,300	3,600
9	24	11 00A	10	9.06	1.60	116.	15.0	8.0	0	270	20.6	298	202	96	832	10	75	4,900	1,300	800
9	25	01 00P	14	9.41	3.48	34.0	5.0	8.2	0	273	21.8	297	204	93	847	10	30	6,300	1,100	170
9	26	02 15P	15	9.12	2.78	43.0	12.0	8.2	0	274	21.7	294	210	84	855	14	35	3,300	#200	90
9	27	01 55P	15	9.33	2.31	53.0	11.0	8.3	0	251	18.4	289	153	136	781	10	50	23,000	800	400
9	28	10 40A	13	9.34	2.06	51.0	2.0	8.3	0	250	18.1	286	192	94	812	12	50	2,300	1,300	220
AV			12	9.27	2.22	53.	9.	8.1	0	268	18.	294	195	99	819	12	#44	10,600	1,300	1,000
11	07	10 25A	6	7.86	21.0	88.	25.	8.0	0			316			740	12	55	172,000	11,000	288,000
11	08	07 36A	4	7.23	15.6	88.	34.	8.0	0			306			827	12	50	221,000	4,000	160,000
11	09	10 00A	6	7.27	22.4	115.	19.	8.0	0	218		309			787	13	55	120,000	2,000	126,000
11	10	06 45A	5	6.46	18.8	242.	40.	8.0	0	220		311			848	14	70	172,000	5,000	110,000
11	11	09 40A	7	7.06	15.	124.	29.	8.0	0	216		306			794	11	60	330,000	5,000	122,000
11	12	07 00A	6	6.90	14.5	115.	32.	8.0	0	215		304			775	12	55	109,000	5,000	350,000
11	13	10 10A	6	7.49	27.	130.	43.	7.9	0	215		304			848	12	50	172,000	2,000	160,000
11	14	06 55A	4	7.39	14.4	115.	28.	8.0	0	214		304			769	13	75	79,000	7,000	400,000
11	15	10 15A	4	7.77	15.4	110.	27.	8.0	0	216		304			775	9	55	278,000	8,000	240,000
11	16	12 30P	4	8.01	30.8	194.	42.	7.8	0	219		299			752	12	95	34,000	2,000	470,000
11	17	04 15P	4	7.94	19.6	185.	45.	7.9	0	220		304			775	13	95	141,000	13,000	340,000
11	18	06 30A	3	7.82	18.2	209.	48.	7.9	0	216		304			812	13	80	172,000	2,000	430,000
11	19	05 45A	3	7.55	21.8	210.	43.	7.9	0	220		305			832	13	110	79,000	8,000	370,000
11	20	02 35A	3	6.98	22.6	282.	58.	8.0	0	216		306			793	14	85	221,000	2,000	350,000
AV			4	7.4	19.79	157.6	36.6	7.9	0	217		305			795	12	70	136,143	5,429	279,714

NOVEMBER - DECEMBER 1962

11	30	10 15A		8.68	24.0	110	26											70,000	5,000	600,000
12	1	09 50A		8.83	15.0	123	26											27,800	9,400	890,000
12	2	10 10A		9.29	6.4	122	27											79,000	14,100	270,000
12	3	10 15A		8.72	6.6	80	13											46,000	4,800	350,000
12	4	10 10A		9.27	8.5	92	33											79,000	4,600	116,000
12	5	10 00A		10.18	7.5	102	25											46,000	7,900	720,000
12	6	09 20A		9.47	8.2	108	33											23,000	13,000	610,000
AV				9.21	10.80	105.3	26.1											52,971	8,414	508,000

• INDICATES LESS THAN

NORTH PLATTE RIVER SURVEY
WYOMING - NEBRASKA
SEPTEMBER & NOVEMBER 1961
RESULTS OF ANALYSES

STATION 10 (NP160.2)

Month	Date	Sample Time	Temp. °C	D.O. mg/l	B.O.D. mg/l	Susp. Solids mg/l	Volatile Susp. Solids mg/l	pH	Alkal. Phenol mg/l (as $CaCO_3$)	Alkal. Total mg/l (as $CaCO_3$)	Cl⁻ mg/l	Hard. mg/l	Ca. mg/l	Mg. mg/l	Specf. Conduct. µmhos/cm.	True Color Units	Turb. Units	Coli. M.P.N. Per 100 ml.	Fecal Coli M.P.N. Per 100 ml.	Fecal Strep. Per 100 ml.
9	21	10 25A	15	7.54	5.19	75.0	19.0	8.0	0	294	26.8	310	213	97	870	13	45			810
9	22	07 45A	11	7.54	4.68	130.	15.0	8.0	0	272	25.4	282	196	86	775	12	90	1,090,000	70,000	22,000
9	23	11 15A	14	8.10	4.21	184.	33.0	8.1	0	288	24.5	298	207	91	827	14	75	90,000	40,000	4,200
9	24	07 40A	11	8.09	5.50	276.	16.0	8.1	0	287	22.3	298	207	91	870	11	120	230,000	50,000	7,000
9	25	07 30A	09	8.69	4.74	1293.	64.0	8.2	0	279	19.8	310	211	99	840	11	210	240,000	33,000	5,500
9	26	03 00P	16	7.90	5.87	789.	49.0	8.2	0	276	22.3	305	206	99	855	15	150	33,000	17,000	500
9	27	02 20P	16	8.28	3.00	510.	54.0	8.2	0	274	21.5	298	205	93	840	9	120	109,000	11,000	600
AV			13	8.02	4.74	465.	35.	8.1	0	281	23.2	300	207	93	841	12	115	299,000	37,000	5,800
11	07	11 50A	7	5.78	28.5	228.	48.	8.0	0			332			800	14	75	230,000	*20,000	750,000
11	08	06 25A	4	5.17	20.8	354.	54.	7.9	0			320			862	12	90	490,000	49,000	390,000
11	09	10 35A	7	5.10	19.6	366.	58.	7.9	0	246		322			832	13	95	240,000	23,000	1,040,000
11	10	08 35A	6	2.38	24.6	432.	77.	7.9	0	248		319			885	13	110	790,000	94,000	2,000,000
11	11	07 50A	6	2.37	32.4	490.	74.	7.9	0	245		324			813	14	170	700,000	11,000	1,880,000
11	12	08 25A	6	3.33	30.1	390.	62.	7.9	0	246		322			794	13	120	790,000	13,000	1,200,000
11	13	11 45A	7	4.51	26.2	360.	52.	7.9	0	240		320			892	18	120	330,000	2,000	510,000
11	14	07 45A	4	3.69	26.9	446.	66.	8.0	0	242		318			806	16	140	460,000	21,000	1,800,000
11	15	11 00A	4	4.50	24.8	398.	49.	7.9	0	242		320			826	17	140	172,000	23,000	700,000
11	16	03 20P	4	5.13	31.6	365.	61.	7.8	0	251		316			800	14	140	490,000	5,000	730,000
11	17	12 20P	4	4.71	31.9	425.	70.	7.8	0	247		318			813	17	160	790,000	14,000	750,000
11	18	08 15A	4	4.54	36.8	492.	86.	7.9	0	246		319			812	13	140	9,200,000	23,000	1,400,000
11	19	06 40A	3	4.42	29.9	522.	99.	7.8	0	241		319			870	17	150	490,000	49,000	2,000,000
11	20	01 55A	4	4.09	27.8	533.	96.	7.9	0	240		322			819	13	160	490,000	33,000	1,500,000
AV			4	4.27	27.99	414.3	68.	7.9	0	244		320			830	14	129	1,118,713	27,692	1,189,285

NOVEMBER - DECEMBER 1962

11	30	09 45A		8.42	26.9	130	23													
12	1	09 30A		8.78	9.7	163	38											109,000	49,000	1,350,000
12	2	09 40A		9.40	5.1	113	33											221,000	70,000	6,600,000
12	3	09 25A		8.85	5.3	124	26											490,000	221,000	1,670,000
12	4	09 30A		9.40	5.0	149	40											330,000	79,000	2,500,000
12	5	09 30A		10.30	6.8	252	37											175,000	70,000	1,270,000
12	6	08 10A		9.43	9.6	153	40											130,000	33,000	1,140,000
																		79,000	49,000	1,220,000
AV				9.23	9.9	154.9	33.9											219,143	81,571	2,250,000

* INDICATES LESS THAN

NORTH PLATTE RIVER SURVEY
WYOMING - NEBRASKA
SEPTEMBER & NOVEMBER 1961
RESULTS OF ANALYSES
STATION 11 (NP154.6)

Month	Date	Sample Time	Temp. °C	D.O. mg/l	B.O.D. mg/l	Susp. Solids mg/l	Volatile Susp. Solids mg/l	pH	Alkal. Phenol mg/l (as $CaCO_3$)	Alkal. Total mg/l (as $CaCO_3$)	Cl− mg/l	Hard. mg/l	Ca. mg/l	Mg. mg/l	Specf. Conduct. µmhos/cm.	True Color Units	Turb. Units	Coli. M.P.N. Per 100 ml.	Fecal Coli M.P.N. Per 100 ml.	Fecal Strep. Per 100 ml.
9	21	10 45A	16	6.79	4.65	120.	32.0	8.1	0	284	27.0	314	211	103	870	12	55			830
9	22	08 05A	11	8.12	5.02	125.	16.0	8.0	0	270	26.8	298	200	98	800	13	90	330,000	33,000	22,000
9	23	10 55A	13	8.50	3.35	337.	41.0	8.2	0	265	22.0	306	206	100	770	14	130	172,000	109,000	7,000
9	24	11 00A	10	8.89	4.72	467.	44.0	8.1	0	255	19.9	298	200	98	775	12	130	70,000	49,000	4,100
9	25	08 00A	10	9.21	5.14	707.	60.0	8.2	0	282	22.4	310	184	126	855	10	200	172,000	70,000	2,700
9	26	02 45P	16	8.14	6.66	499.	48.0	8.1	0	271	22.7	308	178	130	855	16	150	63,000	23,000	800
9	27	01 50P	16	8.30	2.90	357.	22.0	8.3	0	263	20.5	302	178	124	827	8	100	172,000	17,000	1,200
AV			13	8.56	4.63	373.	37.	8.1	0	270	23.0	305	193	111	821	12	122	163,000	50,000	5,500
11	07	12 05P	6	5.62	17.0	188.	37.	8.0	0			332			814	12	70	230,000	220,000	300,000
11	08	06 45A	4	5.48	16.4	347.	66.	7.9	0			319			832	13	80	790,000	33,000	490,000
11	09	10 10A	6	5.25	19.2	405.	59.	7.9	0	242		326			827	13	100	790,000	49,000	280,000
11	10	08 55A	6	4.62	19.	387.	44.	7.9	0	238		324			867	13	95	221,000	109,000	780,000
11	11	11 15A	8	4.55	24.1	492.	76.	7.9	0	245		322			826	14	150	221,000	170,000	640,000
11	12	08 45A	6	5.19	22.	414.	52.	7.9	0	246		322			800	9	100	278,000	13,000	800,000
11	13	10 15A	6	5.33	20.8	351.	53.	7.9	0	242		320			900	12	120	278,000	17,000	340,000
11	14	08 05A	4	5.69	20.8	317.	55.	8.0	0	237		318			806	13	110	330,000	49,000	620,000
11	15	10 40A	4	8.04	19.4	357.	54.	7.9	0	242		319			822	14	130	490,000	13,000	530,000
11	16	01 55P	4	6.01	24.8	323.	49.	7.8	0	246		319			813	12	120	172,000	33,000	470,000
11	17	12 45P	4	5.42	28.2	414.	81.	7.9	0	253		320			805	17	170	330,000	23,000	860,000
11	18	08 40A	2	6.38	26.3	417.	80.	7.9	0	242		320			825	13	150	490,000	79,000	790,000
11	19	04 55A	3	5.06	24.2	493.	84.	7.8	0	243		320			854	14	150	240,000	13,000	810,000
11	20	05 00A	2	6.06	23.6	672.	117.	7.9	0	250		321			832	14	160	330,000	23,000	390,000
AV			4	5.69	21.84	398.3	64.7	7.9	0	243		321			830	13	121	370,714	480,000	578,571

NOVEMBER - DECEMBER 1962

11	30	09 00A		8.57	12.7	126	24											230,000	33,000	1,230,000
12	1	08 45A		9.23	7.2	127	12											109,000	23,000	560,000
12	2	09 00A		9.70	7.3	130	32											79,000	17,000	330,000
12	3	08 45A		9.40	5.3	117	23											79,000	33,000	700,000
12	4	08 50A		9.80	5.7	151	38											141,000	33,000	470,000
12	5	08 40A		10.38	6.2	130	32											130,000	79,000	570,000
12	6	07 40A		9.87	8.7	137	38											348,000	172,000	560,000
AV				9.59	7.59	131	28.4											166,571	55,714	640,000

• INDICATES LESS THAN

NORTH PLATTE RIVER SURVEY
WYOMING - NEBRASKA
SEPTEMBER & NOVEMBER 1961
RESULTS OF ANALYSES
STATION 14 (NP141.8)

Month	Date	Sample Time	Temp. °C	D.O. mg/l	B.O.D. mg/l	Susp. Solids mg/l	Volatile Susp. Solids mg/l	pH	Alkal. Phenol mg/l (as $CaCO_3$)	Alkal. Total mg/l (as $CaCO_3$)	Cl⁻ mg/l	Hard. mg/l	Ca. mg/l	Mg. mg/l	Specf. Conduct. µmhos/cm.	True Color Units	Turb. Units	Coli. M.P.N. Per 100 ml.	Fecal Coli M.P.N. Per 100 ml.	Fecal Strep. Per 100 ml.
9	21	12 20P	16	8.60	4.50	140.	22.4	8.1	0	278	24.5	318	112	106	832	9	85			360
9	22	09 15A	11	8.90	3.07	122.	5.0	8.2	0	262	23.5	306	171	135	763	13	120	49,000	3,300	4,400
9	23	07 45A	10	9.03	3.15	226.	39.0	8.2	0	269	23.1	302	88	214	776	15	150	21,000	13,000	5,300
9	24	08 45A	10	8.85	3.82	162.	25.0	8.1	0	267	23.3	306	72	234	848	14	140	33,000	23,000	5,700
9	25	08 50A	10	9.56	2.87	792.	42.0	8.3	0	266	21.4	310	196	114	819	10	160	46,000	*2,000	1,800
9	26	12 50P	16	9.00	3.44	1036.	68.0	8.3	0	264	22.3	310	146	164	855	14	210	49,000	7,000	1,100
9	27	11 40A	14	9.09	3.07	234.	25.0	8.3	0	268	21.7	312	167	145	848	14	120	34,800	4,900	2,100
AV			12	9.00	3.42	387.	32.3	8.1	0	268	22.8	309	136	158	819	12	126	38,800	8,900	3,000
11	07	02 05P	7	8.34	17.	245.	42.	8.0	0			338			820	13	80	240,000	49,000	118,000
11	08	09 15A	4	8.73	16.	349.	54.	8.0	0			322			848	12	100	1,300,000	13,000	220,000
11	09	07 45A	4	8.05	17.	396.	39.	8.0	0	240		320			827	13	95	221,000	13,000	130,000
11	10	11 20A	7	8.10	14.4	391.	62.	8.0	0	236		326			870	14	100	221,000	17,000	14,000
11	11	09 15A	6	7.60	15.7	410.	45.	8.0	0	237		321			800	15	90	79,000	23,000	230,000
11	12	10 50A	6	8.41	14.6	631.	161.	8.0	0	236		322			812	7	120	109,000	13,000	540,000
11	13	08 30A	4	8.88	14.4	401.	46.	8.0	0	235		315			876	13	110	79,000	5,000	570,000
11	14	10 05A	4	9.05	14.4	321.	54.	8.0	0	232		324			806	12	110	221,000	5,000	300,000
11	15	08 30A	3	8.87	15.8	450.	84.	8.0	0	239		317			814	13	130	221,000	49,000	150,000
11	16	12 55P	2	9.56	17.2	416.	53.	7.9	0	242		324			807	13	120	490,000	8,000	400,000
11	17	02 50P	3	8.90	19.2	481.	85.	7.9	0	246		320			884	14	140	172,000	8,000	390,000
11	18	11 05A	2	9.26	24.4	366.	57.	7.9	0	235		324			825	12	130	430,000	17,000	220,000
11	19	03 20A	2	9.28	17.2	457.	83.	7.9	0	236		320			840	12	130	330,000	2,000	220,000
11	20	03 20A	1	8.70	22.4	369.	108.	8.0	0	240		320			832	13	160	172,000	5,000	410,000
AV			3	8.62	17.1	405.9	69.5	7.9	0	237		322			833	12	115	306,071	16,214	280,143

NOVEMBER - DECEMBER 1962

11	30	03 35A		9.93	10.9	128	24											94,000	11,000	207,000
12	1	08 20A		10.09	6.3	143	33											240,000	27,800	201,000
12	2	08 35A		10.50	4.9	180	35											49,000	33,000	230,000
12	3	09 20A		10.15	6.5	121	23											79,000	33,000	137,000
12	4	08 20A		10.80	10.5	123	33											240,000	240,000	240,000
12	5	08 25A		11.54	5.9	109	35											63,000	46,000	98,000
12	6	07 15A		11.10	6.3	146	42											79,000	79,000	182,000
AV				10.6	7.4	141.4	32.1											120,571	67,114	187,000

* INDICATES LESS THAN

NORTH PLATTE RIVER SURVEY
WYOMING - NEBRASKA
SEPTEMBER & NOVEMBER 1961
RESULTS OF ANALYSES
STATION 16 (GG173-1.5)

Month	Date	Sample Time	Temp. °C	D.O. mg/l	B.O.D. mg/l	Susp. Solids mg/l	Volatile Susp. Solids mg/l	pH	Alkal. Phenol mg/l (as $CaCO_3$)	Alkal. Total mg/l (as $CaCO_3$)	Cl⁻ mg/l	Hard. mg/l	Ca. mg/l	Mg. mg/l	Spec. Conduct. µmhos/cm.	True Color Units	Turb. Units	Coli. M.P.N. Per 100 ml.	Fecal Coli M.P.N. Per 100 ml.	Fecal Strep. Per 100 ml.
9	22	03 00P	17	5.10	17.4	27.0	9.0	8.0	0	337	48.6	278	175	103	943	22	50	230,000	49,000	51,000
9	23	01 30P	16	6.12	5.17	25.0	22.0	7.9	0	393	37.4	350	240	110	990	19	*25	79,000	33,000	29,000
9	24	11 25A	13	6.10	17.4	39.0	27.0	8.1	0	382	38.1	339	233	106	1020	36	70	348,000	348,000	206,000
9	25	08 30A	13	7.66	1.82	4.0	4.0	8.1	0	371	41.4	338	229	109	1030	8	*25	348,000	348,000	6,200
AV			15	6.24	10.4	23.8	15.	8.	0	378	41.3	326	219	107	990	23	*23	251,000	194,500	73,000
11	07	11 10A	36															1,720,000	230,000	12,000,000
11	08	05 30A	38		201.	4225.	348.	7.7		266		312			762	44	800	2,400,000	140,000	17,700,000
11	09	11 25A	36		324.	2224.	236.	7.6		208		305			832	46	900	4,900,000	1,300,000	186,000,000
11	10	07 40A	35		197.	2636.	340.	7.6		209		314			825	50	1000	34,800,000	170,000	35,000,000
11	11	11 50A	35		392.	3348.	400.	7.5		212		307			757	55	1200	14,000,000	49,000	91,000,000
11	12	07 30A	34															7,900,000	20,000	29,000,000
11	13	12 25P	35															7,900,000	130,000	43,000,000
11	14	07 00A	33															3,300,000	50,000	20,000,000
11	15	11 50A	32															7,900,000	110,000	18,000,000
11	16	04 20P	36															17,200,000	330,000	12,000,000
11	17	04 25P	32															13,000,000	80,000	17,000,000
11	18	07 10A	36															17,200,000	20,000	20,000,000
11	19	07 30A	34															17,200,000	20,000	19,000,000
11	20	01 10A	32															1>,000,000	20,000	42,000,000
AV			34		278.5	3108.2	331.	7.6	0	223		309			794	48	975	11,601,429	192,857	40,121,429

NOVEMBER - DECEMBER 1962

11	30	-	240	1448	215
12	1	-	174	1738	338
12	2	-	186	1522	232
12	3	-	182	1600	258
12	4	-	253	1870	500
12	5	-	248	2304	470
12	6	-	161	1530	190
AV		-	200.3	1724.6	314.7

* INDICATES LESS THAN

NORTH PLATTE RIVER SURVEY
WYOMING - NEBRASKA
SEPTEMBER & NOVEMBER 1961
RESULTS OF ANALYSES
STATION 19 (RT208.8)

Month	Date	Sample Time	Temp. °C	D.O. mg/l	B.O.D. mg/l	Susp. Solids mg/l	Volatile Susp. Solids mg/l	pH	Alkal. Phenol mg/l (as $CaCO_3$)	Alkal. Total mg/l (as $CaCO_3$)	Cl⁻ mg/l	Hard. mg/l	Ca. mg/l	Mg. mg/l	Specf. Conduct. µmhos/cm.	True Color Units	Turb. Units	Coli. M.P.N. Per 100 ml.	Fecal Coli M.P.N. Per 100 ml.	Fecal Strep. Per 100 ml.
11	07	07 45A	42															7,900,000	170,000	90,000,000
11	08	10 57A	38															4,900,000	170,000	28,000,000
11	09	07 00A	41															7,900,000	50,000	102,000,000
11	10	10 25A	38															3,300,000	80,000	90,000,000
11	11	06 30A	38															4,900,000	*20,000	114,000,000
11	12	09 55A	46		1170.	1488.	320.	7.2		235	394				892	100	900	*20,000	*20,000	100,000
11	13	07 05A	34		1360.	441.	98.	9.6	48.2	268	453				980	190	900	10,900,000	20,000	19,000,000
11	14	10 15A	40		1030.	1820.	332.	6.9	0	226	476				901	100	1100	7,900,000	50,000	39,000,000
11	15	07 15A	36		1880.	1920.	552.	11.5	279.	559	710					360	1200	3,300,000	*20,000	171,000,000
11	16	03 40P	38															6,300,000	230,000	110,000,000
11	17	12 55P	38															3,300,000	20,000	93,000,000
11	18	09 25A	35															13,000,000	20,000	19,000,000
11	19	03 25A	34															4,900,000	*20,000	510,000,000
11	20	05 00A	35															13,000,000	80,000	340,000,000
AV			38		1360.	1417.2	325.5	8.8	81.8	322	508				924	187	1025	7,038,615	89,000	132,692,308

NOVEMBER - DECEMBER 1962

11	30	08 10A		-	566	1978	227											-	-	-
12	1	08 15A		-	625	1296	204											2,210,000	2,210,000	68,000,000
12	2	08 30A		-	415	2188	228											13,000,000	4,900,000	28,000,000
12	3	08 25A		-	664	2440	306											-	-	-
12	4	08 30A		-	362	1450	192											-	-	-
12	5	08 35A		-	403	1470	194											490,000	109,000	10,300,000
12	6	07 10A		-	427	2098	438											10,900,000	7,000,000	135,000,000
AV				-	494.5	1931.4	255.6											6,650,000	3,554,750	57,825,000

* INDICATES LESS THAN

NORTH PLATTE RIVER SURVEY
WYOMING - NEBRASKA
SEPTEMBER & NOVEMBER 1961
RESULTS OF ANALYSES

STATION 20 (GM18-1.5)

Month	Date	Sample Time	Temp °C	D.O. mg/l	B.O.D. mg/l	Susp. Solids mg/l	Volatile Susp. Solids mg/l	pH	Alkal. Phenol mg/l (as $CaCO_3$)	Alkal. Total mg/l (as $CaCO_3$)	Cl^- mg/l	Hard. mg/l	Ca. mg/l	Mg. mg/l	Specf. Conduct. µmhos/cm.	True Color Units	Turb. Units	Coli. M.P.N. Per 100 ml.	Fecal Coli M.P.N. Per 100 ml.	Fecal Strep. Per 100 ml.
11	07	09 10A	28															13,000,000	300,000	8,400,000
11	08	09 20A	24															17,200,000	490,000	6,300,000
11	09	08 30A	26															22,100,000	200,000	2,600,000
11	10	08 00A	31															10,900,000	*200,000	4,500,000
11	11	08 10A	24															7,900,000	400,000	6,100,000
11	12	08 35A	30		624.	4612.	752.	9.3	37.8	189		323			636	50	1600	13,000,000	200,000	1,400,000
11	13	08 45A	26		670.	5108.	872.	9.2	32.2	188		312			666	70	1800	542,000,000	7,900,000	16,200,000
11	14	08 30A	29		607.	5276.	824.	9.2	35.8	196		332			662	85	1800	7,000,000	*200,000	9,800,000
11	15	08 45A	29		764.	5636.	1056.	9.2	36.0	190		320				50	1800	2,200,000	*200,000	2,700,000
11	16	01 35P	24															10,900,000	*200,000	2,600,000
11	17	02 25P	26															13,000,000	*200,000	11,400,000
11	18	07 50A	24															24,000,000	*200,000	1,500,000
11	19	04 40A	28															4,600,000	*200,000	17,000,000
11	20	03 35A	27															13,000,000	*200,000	46,000,000
AV			26		666.25	5158.	876.	9.2	35.4	190		321			658	63	1750	50,057,143	1,548,388	8,321,429

NOVEMBER - DECEMBER 1962

11	30	-	575	2661	479
12	1	-	530	3688	646
12	2	-	518	4236	774
12	3	-	409	3128	604
12	4	-	496	3794	690
12	5	-	409	3342	624
12	6	-	386	3996	746
AV		-	483.2	3549.3	651.9

* INDICATES LESS THAN

NORTH PLATTE RIVER SURVEY
WYOMING - NEBRASKA
SEPTEMBER & NOVEMBER 1961
RESULTS OF ANALYSES
STATION 21 (GS173.8-3.0)

Month	Date	Sample Time	Temp °C	D.O. mg/l	B.O.D. mg/l	Susp. Solids mg/l	Volatile Susp. Solids mg/l	pH	Alkal. Phenol mg/l (as $CaCO_3$)	Alkal. Total mg/l (as $CaCO_3$)	Cl⁻ mg/l	Hard. mg/l	Ca. mg/l	Mg. mg/l	Specf. Conduct. µmhos/cm.	True Color Units	Turb. Units	Coli. M.P.N. Per 100 ml.	Fecal Coli M.P.N. Per 100 ml.	Fecal Strep. Per 100 ml.
11	07	03 50P	38															7,900,000	490,000	6,200,000
11	08	11 00A	30		1320.	5790.	872.	11.6	262.	513		772			1785	90	2000	2,400,000	50,000	570,000
11	09	11 40A	38		1250.	5516.	720.	9.1	62.0	258		446			953	220	1700	3,300,000	200,000	8,800,000
11	10	07 20A	36		1310.	5656.	1400.	11.3	222.	539		731			1610	270	1900	2,400,000	230,000	4,500,000
11	11	12 00A	33		1700.	6568.	800.	10.0	73.8	358		589			1390	190	2000	4,900,000	110,000	6,100,000
11	12	07 10A	35															2,210,000	*20,000	14,000,000
11	13	12 40P	37															*20,000	*20,000	16,200,000
11	14	06 40A	35															*20,000	*20,000	9,300,000
11	15	12 05P	37															3,300,000	330,000	60,000,000
11	16	04 35P	34															2,400,000	20,000	24,000,000
11	17	04 35P	34															2,780,000	50,000	14,000,000
11	18	06 45A	32															790,000	20,000	66,000,000
11	19	07 40A	30															4,900,000	50,000	10,200,000
11	20	12 55A	34															2,400,000	200,000	3,000,000
AV			34		1395.	5082.5	948.	10.5	154.9	417		634			1435	192	1900	3,306,666	159,091	20,240,714

NOVEMBER - DECEMBER 1962

11	30			-	1347	8134	979													
12	1			-	1264	8362	992													
12	2			-	*2398	7716	942													
12	3			-	1186	8324	944													
12	4			-	2228	9118	1124													
12	5			-	1468	12414	1306													
12	6			-	1540	8292	1006													
AV				-	1633	9051.4	1041.9													

* INDICATES LESS THAN

NORTH PLATTE RIVER SURVEY
WYOMING - NEBRASKA
SEPTEMBER & NOVEMBER 1961
RESULTS OF ANALYSES

STATION 22 (CB150-2.5)

Month	Date	Sample Time	Temp. °C	D.O. mg/l	B.O.D. mg/l	Susp. Solids mg/l	Volatile Susp. Solids mg/l	pH	Alkal. Phenol mg/l (as $CaCO_3$)	Alkal. Total mg/l (as $CaCO_3$)	Cl⁻ mg/l	Hard. mg/l	Ca. mg/l	Mg. mg/l	Specf. Conduct. µmhos/cm.	True Color Units	Turb. Units	Coli. M.P.N. Per 100 ml.	Fecal Coli M.P.N. Per 100 ml.	Fecal Strep. Per 100 ml.
11	07	12 30P	32															230,000	*20,000	7,500,000
11	08	07 15A	31															16,000,000	63,000	11,000,000
11	09	09 45A	31															16,000,000	141,000	12,600,000
11	10	09 20A	32															3,300,000	70,000	67,000,000
11	11	11 00A	34															3,300,000	200,000	19,000,000
11	12	09 10A	30															790,000	80,000	13,000,000
11	13	10 40A	31															3,300,000	*20,000	9,800,000
11	14	08 25A	30															10,900,000	20,000	8,000,000
11	15	10 15A	29															7,900,000	20,000	18,000,000
11	16	02 15P	32		550.	4952.	792.	8.9	20.6	204		340			770	55	1200	4,900,000	*20,000	11,000,000
11	17	01 05P	32		576.	6392.	976.	9.0	23.4	210		355			769	55	2300	10,900,000	*20,000	11,200,000
11	18	09 05A	29		606.	5796.	944.	8.9	21.2	198		324			775	48	1700	24,000,000	20,000	20,000,000
11	19	06 10A	24		600.	7512.	880.	8.9	18.2	224		355			800	50	2300	4,600,000	20,000	6,300,000
11	20	02 10A	26															7,900,000	*20,000	9,600,000
AV			30		583.0	6163.	898.	8.9	20.8	209		340			779	52	1875	8,144,286	70,444	16,000,000

NOVEMBER - DECEMBER 1962

11	30		-	632	3940	656														
12	1		-	578	4522	762														
12	2		-	337	3278	498														
12	3		-	864	4240	664														
12	4		-	489	3634	658														
12	5		-	658	7892	1290														
12	6		-	922	4294	758														
AV			-	639.9	4542.9	755.1														

* INDICATES LESS THAN

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NORTH PLATTE RIVER SURVEY
WYOMING - NEBRASKA
SEPTEMBER & NOVEMBER 1961
RESULTS OF ANALYSES
GRAPHICS 23 (CD150-2.0)

Month	Date	Sample Time	Temp °C	D.O. mg/l	B.O.D. mg/l	Susp. Solids mg/l	Volatile Susp. Solids mg/l	pH	Alkal. Phenol mg/l (as CaCO3)	Alkal. Total mg/l (as CaCO3)	Cl⁻ mg/l	Hard. mg/l	Ca. mg/l	Mg. mg/l	Specf. Conduct. µmhos/cm.	True Color Units	Turb. Units	Coli. M.P.N. Per 100 ml.	Fecal Coli M.P.N. Per 100 ml.	Fecal Strep. Per 100 ml.
11	07	12 20P	6															490,000	*20,000	490,000
11	08	07 05A	1															2,400,000	20,000	640,000
11	09	09 55A	4															2,210,000	20,000	360,000
11	10	09 10A	3															4,900,000	*20,000	1,800,000
11	11	10 55A	8															490,000	*20,000	530,000
11	12	09 00A	4															1,720,000	*20,000	1,200,000
11	13	10 30A	4															2,400,000	20,000	630,000
11	14	08 15A	1															2,210,000	20,000	1,500,000
11	15	10 25A	2															270,000	*20,000	870,000
11	16	02 05P	1		174.	56.	44.	7.6	0	388		480			1052	50	90	790,000	*20,000	2,300,000
11	17	12 55P	2		176.	77.	57.	7.7	0	340		442			953	65	100	3,300,000	*20,000	1,100,000
11	18	08 55A	1		231.	56.	23.	7.7	0	342		441			951	55	60	3,300,000	*20,000	1,800,000
11	19	06 20A	0		236.	384.	73.	7.8	0	372		490			1041	50	240	790,000	*20,000	2,300,000
11	20	02 20A	0															1,720,000	*20,000	4,700,000
AV			2		204.25	143.2	49.2	7.7	0	395		464			999	55	122	1,927,857	20,000	1,444,286

NOVEMBER - DECEMBER 1962

11	30	-	272	38 x	32	
12	1	-	305	58 x	55	
12	2	-	*359	49 x	46	
12	3	-	*339	77 x	41	
12	4	-	330	115 x	62	
12	5	-	258	54 x	-	
12	6	-	273	85 x	59	
AV		-	305	68	49.2	

* INDICATES LESS THAN

x - MILKY - WHITE, DIFFICULT TO GET 100 ML FILTERED

APPENDIX B

GUIDE FOR WATER POLLUTION CONTROL ACTIVITIES
MISSOURI DRAINAGE BASIN

Adopted January 7, 1954
Engineering Section
Missouri Basin Health Council

Subject to (a) such higher objectives as may be desired by any State and (b) such other modification as may be deemed necessary, after appropriate investigation, by the State Water Pollution Control Agency concerned, the Engineering Section, Missouri Basin Health Council recommends the following for consideration by the member States as a tentative guide for water pollution control activities in the Missouri Drainage Basin:

1. Toxic substances including metallic ions, phenolic compounds, oils, alkalies, and acids should be virtually eliminated from sewage effluents.

2. Removal of settleable and floating solids to prevent sludge banks, floating materials, and nuisance conditions should be required as the minimum acceptable treatment.

3. For industrial wastes similar in nature to municipal wastes, treatment should be based on the same premise as recommended for municipalities. For industrial wastes not comparable to municipal wastes, treatment should be provided as necessary to prevent deterioration of water quality for beneficial uses in the receiving stream.

4. Additional treatment over that specified in item 2 above should be provided as necessary to protect downstream water uses. Quality objectives for certain water uses are:

   (a) For water serving as a source of domestic supply, raw water bacteriological quality should conform to that recommended in "Manual of Recommended Water Sanitation Practices, 1946, Public Health Bulletin #296," pages 11-13.

   (b) "For bathing or swimming waters, monthly arithmetical average 'most probable number' of coliform organisms should not exceed 1,000 per 100 ml during any month of the recreation season; nor exceed this number in more than 20 percent of the samples examined during any such month; nor exceed 2,400 per 100 ml on any day. For nonbathing or nonswimming waters, the monthly arithmetical average